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VIEWS, NEWS AND INTERVIEWS.

Anton Bach, a machinist employed at the Rushmore Dynamo Works, in Jersey City, N. J., did not report for work one morning last week, but came around after the dinner hour and was informed that he was discharged. He demanded the wages due him and was told to call Saturday. He refused and insisted on an immediate settlement, and wanted to wipe up the floor with Mr. Rushmore. The telephone quickly brought a policeman, who ejected Bach. Of the 26 other machinists, six who belonged to a union quit work. The seven strikers spent several hours in the saloons in the neighborhood, and then went in a body to the various newspaper offices and told of the strike. It was an immense advertisement for Mr. Rushmore, and the next morning his factory was besieged by over 200 non-union men looking for work. The seven vacancies were quickly filled with first-class men, and a short time later, when the blustering walking delegate called to arbitrate, he was given a merry laugh and advised to keep on walking.

Mr. Oliver Heaviside has been offered a pension from the Civil List by Queen Victoria and has accepted it. He is a mathematical physicist of deep erudition and has worked out innumerable problems in telegraphy and telephony.

Not long ago the Broadway cable road, in New York city, placed in service a number of handsome open cars to be used as smoking cars. They immediately jumped into popularity with the public. As smoking is allowed in any part of the car, it was thought that ladies would not ride in them. But such is not the case. Cars are frequently seen carrying as many women passengers as men. This is regarded as a great triumph by the smokers, many of whom think that in a short time smoking will be allowed in any part of an open car, cable or electric.

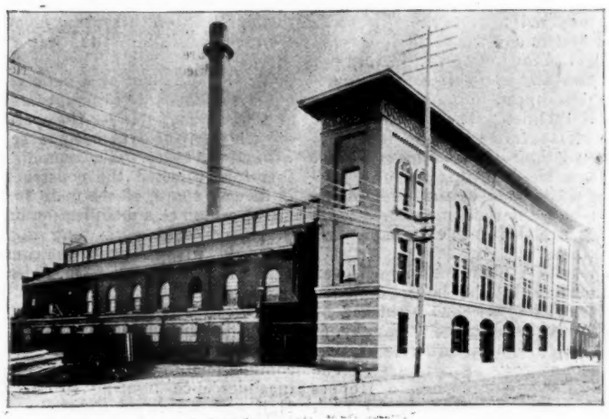
The walking (?) delegate of the Electrical Workers' Union, in New York city, has been provided with a bicycle, and is now known as the "biking" delegate.

A French paper says that an electric boat has been constructed for the purpose of visiting and inspecting some of the large sewers. The boat is warped with a chain, which it picks up as it goes along, according to a practice employed elsewhere in France, and the motive power is a Fulmen accumulator battery.

The directors of the Rand Central Electric Works, Limited, state that, notwithstanding the recent troubles in the Transvaal, they expect to be ready to supply power by November. The troubles had really nothing to do with them, as far as I can see. Theirs is a light job; Dr. Jameson's was not. —*London Electricity.*

About a month ago the Brooklyn Heights Railroad Company, of Brooklyn, N. Y., tried the experiment of running bicycle cars on their Broadway Ferry lines. It is now said that the cars have not been well patronized and, at the present time, the company has no intention of extending the service. It would be impossible to carry wheels on the ordinary passenger cars of the company, and the necessary delay of getting bicycles checked and then waiting at one's destination for the car to arrive is not seemingly popular with bicyclists. The service has been carried on by using the express cars on Sundays as bicycle cars.

A correspondent of the New York *Sun* writes as follows: "Being short-sighted and constantly wearing spectacles, I find that whenever I need to listen intently, as to a strange sound in the night, or answering a call to the telephone, I invariably put on my glasses. This, even if the room is dark. I have long noticed this peculiarity, and ascribe it to a desire to put the one sense completely at ease or into a normal condition before exercising the other to any unusual degree."



OFFICE AND STATION BUILDINGS OF THE DETROIT, MICH., MUNICIPAL ELECTRIC LIGHTING PLANT.

In its issue for July 10, 1896, the London *Electrician* printed the following at the head of its editorial columns:

In the death of Sir John Pender, the *Electrician* has lost a proprietor who was proud of his connection with the journal, and careful of its good name, and who showed his trust in those directly responsible for its management by leaving them unfettered discretion.

ELECTRIC LIGHTING IN DETROIT.

INTERESTING FACTS AS TO MUNICIPAL OWNERSHIP GLEANED FROM THE FIRST ANNUAL REPORT OF THE PUBLIC LIGHTING COMMISSION.

The electrical field has been watching with interest the development of the municipal electric lighting plant at Detroit, Mich., which has now taken over all the city lighting, formerly carried on by contract with the Detroit Electric Light and Power Company. The public lighting commission has rendered its first annual report to the Common Council, covering the fiscal year ending June 30, 1896.

On June 30, 1884, the Brush Electric Light Company was supplying to the city, current for 24 arc lamps at a cost of $3,649.53, an average cost of $152.07 per lamp per year. In 1885 the same company supplied current for 300 lamps at an average cost of $239.94 per lamp. In 1890 the Brush company supplied current for 719 lamps at an average cost of $191.84 per lamp.

The next year, that is, 1891, the Detroit Electric Light and Power Company underbid the Brush company and secured a contract for 1,031 lamps at an average cost of $129.69 per lamp. In 1894 this company was supplying 1,279 lamps at an average cost of $132.41 per lamp. In 1895 a portion of the city was lighted the last three months by the public lighting plant, although the Detroit Electric Light and Power Company received $153,004.36 for the current it supplied during the remainder of the year. In 1896 the company received $28,796.41 for three months' service. The last nine months the entire city was lighted by the public lighting plant.

In accordance with the provisions of an act passed for the purpose the question as to whether the city of Detroit should establish a municipal lighting plant was submitted to a vote at the election held on April 3, 1893. The vote resulted as follows: Yes, 15,282; No, 1,245. On April 25, 1893, the Common Council passed a

resolution determining it advisable to establish a municipal plant, and on May 24, the public lighting commission was directed to make the necessary purchase of lands, machinery, wires, etc., to carry out the object of the lighting act. On May 9, 1893, the Common Council authorized the issue of $600,000 of bonds to defray the cost of building the plant. On December 23, the bonds were sold at a premium of $27,540 for the entire issue.

The public lighting commission was formed in accordance with the provisions of the act creating it on June 14, 1893. Mr. Alex. Dow was appointed as the city electrician. Mr. Walter D. Steele was appointed assistant city electrician on June 3, 1895. In July, 1893, Mr. Dow was authorized to employ Mr. Jesse M. Smith, of Detroit, and Prof. H. S. Carhart, of Ann Arbor, as consulting engineers in preparing plans and laying out the work of the commission. Mr. Dow served as city electrician until July 1, 1896, having declined a reappointment. Mr. Walter Steele was appointed to succeed Mr. Dow, and Mr. Will F. Conant was appointed secretary and general manager.

The plant is located on the south side of Atwater street on the river front. The central station consists of a brick office building three stories high, having a frontage of 136 feet on Atwater street with a width of 35 feet at the west end and of 14 feet at the east end. The front of this building was made tapering in shape, to conform to the street line. The first floor of the office building is divided into convenient rooms for machine and blacksmith shop, storeroom, trimmers' room, carpenter shop and supply storeroom. The second story is devoted to the offices of the commission and secretary, the electrical engineer, draughting room and lamp repair room. The third floor is divided into two large rooms for storage of globes, patterns and bulky supplies.

In the rear of this building, and separated from it by an alley 16 feet wide, is the power house, the foundations for which were made by excavating to the river level and driving 1,893 elm piles 23 feet long. These piles were capped with oak timbers, and the timbers cross-planked with oak. The power house contains an engine and dynamo building 50 by 150 feet in size, and a boiler house, 48 by 150, the two being joined together by a smaller building, 17½ by 150. The floors of the boiler room and basement of engine room are of artificial stone, and the floor of the engine room proper is of four-inch Norway pine plank, eight feet above the basement, the plank covered with one and one-quarter-inch matched hard maple. The small building between the engine and boiler houses contains the office of the station where the engineer on watch has his headquarters. Adjoining is a wash room, with lockers for the men's clothing; shower bath and closets for the engineers. Next to this is a similar wash room for the firemen, oilers and other men about the plant. Then comes the stack room, out of which rises the smoke-stack, built of steel plates and bricked inside, having an average diameter of nine feet, and being 150 feet in height, with a 15-foot foundation, making the top of the stack 165 feet above the level of the river. This room also contains the heater and hot well. Next comes the pump room, containing the condensers, fire-pump and engine and dynamo for the incandescent lighting necessary in the daytime. The last room next the office building is fireproof and contains tanks for the lubricating oils, kerosene oil, paints and other inflammable material. Adjoining the boiler house are the coal bins, 10 in number, capable of holding 800 tons of lump coal. A railway track alongside the bins connects with the Lake Shore and Grand Trunk tracks at Rivard street. The roofs of the plant are the ordinary steel truss covered with slate, while those of the office and pump room buildings are of copper. All the buildings are heated by steam, and a complete iron pipe sewer system surrounds and runs through them, discharging into the river at the lower side of the property. Water for the condensers and for fire protection is obtained by means of a 16-inch intake pipe opening into a crib built in the dock, the mouth of the pipe being eight feet below the normal level of the river. A similar pipe for discharging the overflow from the hot well opens into the crib two feet above the intake pipe. The cost of constructing these buildings was $72,247.78.

One of the first things decided upon by the commission was the construction of an underground system of distribution in the territory within a half-mile radius from the City Hall. This system consists of vitrified clay tile laid in concrete for the main line, and two and one-half-inch wrought-iron pipe dipped in graphite paint for the lateral lines. The total mileage of conduit is as follows: Main line, 34.43 miles; lateral lines, 6.3 miles; total, 40.73 miles. Of this amount, 12.7 miles is occupied by the public lighting cables, the remaining 28.03 miles being available for extensions and rental.

The steam plant consists of seven double-deck tubular boilers designed by Mr. C. C. Peck, and furnished by Charles A. Strelinger & Company, of Detroit. Each boiler has a heating surface of 3,000 square feet. The feed-water enters through a Hoppes purifier attached directly to each boiler. The furnaces are of the Hawley down-draft type. They were selected with a view of securing economical and smokeless consumption of soft coal. The results in both directions are satisfactory.

There are five engines, each having three cylinders, 11¼, 18 and 29 inches in diameter, respectively, with a stroke of 18 inches and running at 200 revolutions per minute. The initial steam pressure is 160 pounds, and the highest economy is obtained when indicating not less than 250 nor more than 340 horse-power. The exhaust steam from the cylinders of the feed pumps is not condensed, but is used during the Winter months for the heating of the buildings, and during the Summer months to increase the temperature of the boiler feed-water.

The electric plant is in two sections, the larger for lighting the streets, the second for the incandescent lighting of the public buildings within a half-mile circuit. A very wide investigation was made by the commission during the latter part of the year 1893, into the state of development of apparatus adopted for the lighting of streets and public places. The commission became convinced that the only improvement to be looked for at an early date was the development of the arc lighting dynamos of 60 or 70 lights capacity into larger sizes of greater efficiency; and, believing that this progress would be assisted by a call for such machinery in a plant of the size and character of the one to be installed in the city of Detroit, they prepared specifications for dynamos of 50 kilowatts output at 500 revolutions, and of 86 per cent commercial efficiency. It is to be noted that the largest standard size at that time in this class of machinery was a dynamo of 32 kilowatts, and that the efficiency was little over 70 per cent. The result of these specifications was the receiving of bids from every leading manufacturer with the most complete guarantees of the operation and efficiency of the proposed machinery. A bid on alternating machinery was received and very carefully considered, but rejected.

A contract was entered into with the Western Electric Company for the supply of eighteen 50-kilowatt constant-current dynamos for series arc lighting. Another contract was entered into with the Brush Electric Company for the supply of 1,500 series arc lamps. Certain improvements in the detail of the arc lamps were required in the specifications, but the essential mechanism of the lamps was the same as the Brush company's standard for the last four years. The dynamos and lamps, after operation by the city's employés for 90 days, and after an exhaustive test by expert engineers, were found to conform to the specifications and have remained in continuous and satisfactory operation.

The arrangement of station connections for these dynamos, involving the handling of currents at a voltage of 5,000 to 5,500 volts, was given very careful study. There was not found in the market a satisfactory main switchboard, although a unit switchboard suitable for the operation of each group of dynamos was secured without difficulty. The commission, therefore, directed the construction, in its own shops, of the main switchboard, which is a modification of the plug and cord style long in use, equipped with Weston instruments and with a bank of incandescent lamps for testing purposes. This board, after a year's service, has proved entirely satisfactory.

The original instructions of the commission required it to furnish incandescence lighting to the City Hall and Municipal Court Building, and, of course, to the Public Lighting Buildings. This service is required 24 hours a day, and all three buildings are within the half-mile circle, within which wires are ordered to be placed underground. If the cables were to be installed and machines run 24 hours a day, it was desirable, for economy, that all the incandescence lighting of public buildings, which could be readily connected to the cables, should be done by the public plant. Representation to this effect to the different departments and commissions of the city secured their concurrence, and machinery was installed and cables laid for the lighting of 14 buildings, wired for a total of 2,503 lights.

The machinery for incandescence lighting was purchased from the Westinghouse Electric and Manufacturing Company. It consists of three 55-kilowatt, alternating-current dynamos of the two-phase type, with transformers and station instruments. The primary voltage is 1,100; the secondary is 110 volts.

Two of these alternators are connected to the engines which run the arc-lighting dynamos; the third alternator is connected to a non-condensing, compound Westinghouse engine, which runs during the daylight hours, so that it is not usually necessary to operate a triple-expansion engine or condensing machinery excepting during street lighting hours. The exception to this is during the two mid-Winter months, when the incandescence lighting load in the evening rises above the capacity of one alternator.

The 18 arc dynamos and two alternators are connected to the five triple-expansion engines in sets of four, by rope-driving gear. Each dynamo has seven endless cotton ropes of seven-eighths of an inch diameter, and each of the two flywheels of the engine has 14 grooves, so that the four sets of seven ropes are divided equally between the two wheels. It has not been found necessary to use any tension carriage with these ropes. The diameters of the pulleys are, on the engines 84 inches, and on the dynamos 34 inches.

The distribution system is divided into two sections: The first is the underground district, in which there are connected 184 arc lamps and the 2,503 incandescent lights for building lighting already referred to. The cables (which are drawn into conduits, previously described) are rubber insulated with tape and lead covering over the rubber. The arc circuit cables have a wall of rubber 7-32-inch thick around a No. 4 copper conductor. The feeder cables of the alternating system are identical with the arc cables. The mains have a 9-64-inch wall of rubber around a No. 8 copper conductor. These cables have been underground at the time of writing for 18 months, and in operation for 15 months, and are apparently as perfect as when first installed. They were furnished by the Safety Insulated Wire and Cable Company, of New York.

The second section is the overhead district, which supplies all the street lighting except that within the half-mile circle. There are connected to these lines 1,309 arc lamps. The poles set by the lighting commission number 4,378 and vary in length from 40 to 70 feet. They are of cedar, up to a length of 55 feet; those of greater length, 220 in number, are of Norway pine. The location of the plant in the underground district involved a special study of the manner of connecting with the lines in the overhead district. It was considered undesirable to connect these lines into the general system of underground cables, because of the serious risk of injury to cables by lightning discharges. The best method appeared to be the construction of a tunnel of such dimensions as to permit the stringing of wires in the same general plan as is used on overhead work, and the commission looked favorably upon this plan, believing that the construction of such a tunnel or subway was certain to be required by the growth of the service. Under the existing conditions, however, the commission did not see their way to incur the expense, and it was decided to erect a special line of high poles through the streets nearest to the river, the poles being so located as to cause a minimum of obstruction to traffic, and of such height as to cause a minimum of interference in the operations of the Fire Department in case of fire. The line of 70-foot poles so planned and erected will serve, it is believed, all purposes until such time as the subway can be constructed. Since the erection of this main line, the location of two new railway power houses on the river front, just east of the underground district, has involved the construction of a heavy line of feeders for the electric rail-

way systems. These feeders, under an arrangement made by the commission, have been placed on the main line of poles, and an annual rental is collected for this use of the poles.

The city's wires on the overhead lines are of special weatherproof insulation, the wires on the main line being all hard-drawn copper, and on the subsidiary lines annealed copper. The total length is 329 miles. A single petticoat glass insulator of extra length is used throughout the system, and rubber-insulated wire and hard-rubber bushings are used wherever there is any special risk of leakage. These overhead lines, while subject to the ordinary accidents of operation of such constructions, have so far caused very few interruptions of service, and those of a trifling character. A patrol system is maintained, and points where trouble can be anticipated are carefully watched.

As between overhead construction and underground construction, the experience of the Lighting Commission is that the underground construction is infinitely preferable. The only fault to be found with it is its first cost. Underground cables will certainly last longer than overhead circuits. The conduits are of imperishable material, and under the conditions of the Detroit underground insulation, interruptions of service are entirely unknown.

Johnson & Steele Automatic Potential Arrester.

This instrument is the invention of W. Claude Johnson and L. J. Steele, and is manufactured by Messrs. Johnson & Phillips, of Charlton, Kent, England. It is employed for automatically arresting the rise of potential, such as is induced on breaking the field-magnet circuit of a dynamo or other circuit of high self-induction; the electro-motive force in such a case being, as is well known, sometimes sufficiently high to break down the insulation of the coils or of conductors and instruments connected to the circuit. The device is connected as a shunt to the inductive circuit, and consists, as is seen in the accompanying illustration, taken from our London namesake, of two carbon disks mounted side by side on a slate base. These disks are pressed towards each other by springs, but between them is interposed a strip of mica of suitably adjusted thickness, which, not being so wide as the faces of the disks, leaves a small air space between them. A safety fuse is provided which, in case of a permanent circuit being established between the disks, will give way and thus prevent short-circuiting the field. The disks can be turned on their axes so as to present towards each other fresh portions of their peripheries, which are cleaned by metal scrapers that bear against them. If the field circuit of a dynamo is broken accidentally or otherwise, the difference of potential at its terminals will rise to an amount sufficient to produce a spark between the two disks, and this spark will last until the field has gradually died down. In some cases, especially when breaking the field circuit of large multipolar machines or alternators, the spark is seen to last as long as 20 to 30 seconds. Messrs. Johnson & Phillips have supplied a large number of these instruments.

ELECTRICITY AND WATER POWER.

BY MARK A. REPLOGLE.

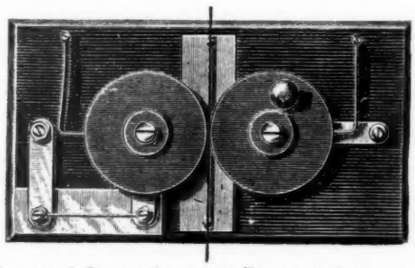
(Continued from page 26.)

PART II.

THE FOLSOM, CAL., POWER AND TRANSMISSION.

Of the recent demonstrations of long-distance transmission, none stand out more boldly, or have attracted such world-wide attention, as the development at Folsom, Cal., by the Folsom Water Power Company and the Sacramento Electric Power and Light Company.

There are various reasons for this interest. The first and greatest, perhaps, is that it was the first attempt to transmit great quantities of power electrically to so great a distance in the western hemisphere; second, the work from beginning to end is American. While the Niagara Falls Power Company were investigating the work of European engineers and incorporating their ideas into the great plans adopted, the Folsom plant was steadily and surely being crowded to completion by native Americans. Another cause of interest is its locality. The great coal fields that help to enrich the eastern and middle sections of our country are wanting on the Pacific coast, but the mental energy that causes nature to contribute to the welfare and happiness of mankind is not wanting. The spirit of turning promptly into account the lessons so recently taught us by science, is so marked in this great transmission, that its success stands out a new and blazing star in the glory that crowns the already famous Golden State.



JOHNSON & STEELE AUTOMATIC POTENTIAL ARRESTER.

A most singular coincidence, too, is that this great power plant is located only a few miles from the spot that produced the first gold in California. The whole world was electrified by the developments in the American River valley in "49." In "94" a great work was nearing completion that was soon to electrify the scientific world with positive demonstration that 4,000 horse-power can be carried 22 miles as a profitable investment to the promoters of such a project, as well as to the patrons of the power and light furnished.

The power house is situated at Folsom City, 22 miles North and East of Sacramento, the capital of the State. The American River is a tributary of the Sacramento River, and its many sources are high in the Sierra Nevada Mountains. Folsom is situated at a point where the river finds the level lowlands, and is the remains of a once flourishing mining town. Its great areas of washed surface, and its tumbled-down appearance, are the only indices to its former greatness. The surface of the lowlands is composed of a tough red and gravelly till, but the foundation rock is a good quality of gray granite.

About two miles up the rocky gorge from Folsom, at the head of a series of rapids, the great plant gets water from the river. At this point is constructed one of the finest granite dams in America. The head-works are constructed of cut granite and are equipped with hydraulically moved gates. From here a great canal is cut through the granite bluffs nearly 2,000 feet to the State prison power house. At this point about 800 horse-power is used for manufacturing, and in the various operations pertaining to the quarrying and handling of the fine cut granite produced by the State in its prison works.

This canal is extended to Folsom City, one and one-half miles below the prison, to a high bluff situated between the town and river. On this bluff is constructed a double forebay, and each basin is tapped by two of the great penstocks that carry water to the four pairs of horizontal turbines below. Each penstock is provided with a hydraulically moved gate.

The power house is two stories high and is substantially built of brick. It contains four units of power, duplicates of each other. Each unit consists of a pair of specially built horizontal turbines that furnish 1,260 horse-power under 55 feet head. The turbine shaft is connected directly to a 1,000 horse-power three-phase generator, that furnishes to the step-up transformers a current of 800-volts pressure. The turbines make 300 revolutions per minute, and have connected at the opposite end from the dynamos a 15,000-pound flywheel, to aid in their government.

There are, besides the four 750-kilowatt generators, two 500-volt exciters. These are driven by two smaller turbines. The six dynamos occupy the first story of the power house, where is also found the switchboard. The turbines are in a wheel house beside the dynamo room, and their great shafts extend through the brick walls.

The second story of the power house contains the 12 step-up transformers that receive the 800-volt current and transform it to a current of 11,000 volts, ready for transmission. There are also two rotary blowers to keep the transformers cool when heavily loaded.

Two well-constructed pole lines carry this high-tension current to the sub-station in Sacramento, 22 miles distant, where it is again transformed by the step-down process to the various pressures convenient for the work to be done.

The sub-station is a very substantial and neat brick building located on the corner of Sixth and H streets. It contains three large synchronous motors that receive current at 500-volts pressure from the transformers in the second story. These motors drive the street railway generators that furnish power for all the street cars in the city. They also drive the great arc dynamos that furnish light for the streets. The three mentioned motors can all be connected to one drive shaft, from which all the dynamos can be driven.

The incandescent lighting current leaves the transformers at a pressure of 125 volts, on a four-wire system, to all parts of the city. Three wires are for the three-phase current, and the fourth is a neutral wire.

Power can go directly from the transformers to synchronous and induction motors, or it can be furnished from the street railway generators. The sub-station contains the offices of the company, and with the exception of the wires overhead, it has the appearance of a neatly designed business block. (A vast improvement over ordinary electric stations.)

This great plant started up on July 14, 1895, and has been running night and day ever since. It has demonstrated that great quantities of power can be carried great distances; it has demonstrated that communities lacking natural fuel may still be rich in power, and it has demonstrated that Americans can build great electrical power plants, and adapt themselves to the conditions that nature provides.

The water supply at Folsom is sufficient for several more such power stations when they are demanded.

(To be continued.)

One Hundred Thousand Penberthy Injectors.

The Penberthy Injector Company, of Detroit, Mich., celebrated on July 25, the manufacture and sale of 100,000 Penberthy injectors. The first Penberthy injector was made by this firm on June 5, 1886, and was numbered "No. 1." Number 100,000 was made on May 12, 1896, so that in a little less than 10 years 100,000 of these devices have been turned out and sold.

The celebration took the form of a holiday and excursion for the employés, customers, and friends of the company. The steamer "Sappho" conveyed the crowd to Beauvoir, on the St. Clair River, where the day was spent. Refreshments were served, and music, games, and dancing were enjoyed.

The New England Telegraph and Telephone Company has purchased the building at 208 Newbury street, Boston, to furnish Back Bay people with an exchange of their own. The property is assessed for $24,000 and has 2,688 square feet.

SIR JOHN PENDER.

SOME EPISODES IN HIS INTERESTING CAREER.

Sir John Pender, who was so largely responsible for the success of ocean telegraphy, and who died on July 7, as announced in the ELECTRICAL REVIEW at the time, had an eventful and interesting career. Some incidents of his life are contained in a lengthy cablegram received in New York over the lines of the Direct United States Cable Company, by Mr. James Brown, superintendent of the company. The following is an abstract of this message:

A striking allusion to the crisis in ocean telegraphy, at which Sir John Pender so happily intervened, was made by the late Lord Derby eight years ago, when Lady Pender was publicly presented with her husband's portrait. Speaking of the Atlantic Cable, his lordship said: "It is not too much to affirm that but for Sir John Pender, and a few others of whom he was chief, that enterprise would have collapsed, and at the best a long delay would have occurred before investors consented to risk their capital in such a speculation again." Admitting that the enterprise would have been accomplished at some date or other, Lord Derby argued that in such a case "the loss of time represented by even one generation would have meant almost incalculable loss, material loss, to England." In his further remarks, it was shown how Sir John had made this particular victory the starting point of other enterprises scarcely less important, and in their aggregate perhaps of even greater consequence than the laying of the Atlantic Cable. Thus, Sir John became chairman of the company which laid the first line to India, and was mainly instrumental in establishing communication with Australia and China. It was also due, in a great measure, to his exertions that South Africa became connected telegraphically with England. Energetically supported by the present Marquis of Tweeddale and the late Sir James Anderson, an amalgamation of enterprises was formed by which oceanic telegraphy obtained a world-wide extension.

Possessing great discernment of character and keen commercial sagacity, Sir John Pender was highly qualified as an organizer and an administrator. He knew the value of scientific research, and for that reason invoked the aid of such authorities as Lord Kelvin, Dr. Alex. Muirhead, Mr. Herbert Taylor and others in these matters which related to the working of telegraph cables. The staff whom he gathered round him were eminently qualified for their duties, and the personnel of his companies throughout the world proved worthy of the position so occupied. The extent of the work which had thus to be controlled is shown by the fact that the capital of the submarine telegraph companies, over which Sir John presided, was not much less than £15,000,000, while the aggregate length of the cables exceeded 73,000 nautical miles, bringing in a revenue last year of £2,153,000, the reserve funds standing very nearly at £3,000,000.

Not limiting his attention to submarine operations, the same indefatigable worker and organizer was chairman of the Metropolitan Electric Supply Company, which maintained last year upwards of a quarter of a million of lights and takes a foremost place among such undertakings. In respect to the telegraph cable companies of which Sir John was chairman, it is to be observed that they have not merely lived, but grown, thus affording practical evidence of the ability with which they have been conducted, their value in the share market being a fair test of their soundness and success.

On such a man it was natural that honors should descend, though of these he had no excess. His public services were unquestionable and, in recognition of these, Her Majesty in 1888 made him a knight commander of the Order of St. Michael and St. George, followed in 1892 by advancement to a grand cross of the same order. In 1870 the Prince of Wales was present at Sir John Pender's house in Arlington street to celebrate the completion of the connection by oceanic cables of England with India. Twenty-four years later, when Sir James Anderson had passed away, Sir John presided at the Imperial Institute, at the silver jubilee of the formation of the company for the establishment of submarine telegraphy to the East and Far East, and on this occasion he was again honored with the presence of the Prince of Wales. Some time ago, when visiting Constantinople, Sir John received from the Sultan the grand cordon of the Medjidieh, the honor being the highest that could be granted to an alien. Other rulers indicated their appreciation of Sir John Pender's labors by similar marks of distinction. Among the orders conferred were those of the French Legion of Honor, the Italian Knight Grand Cordon of the Crown, the Portuguese Order of the Rose, and the Greek Cross of Commander of the Royal Order of the Savior. At quite a recent date, the French Government conferred upon Sir John its highest colonial order, that of Commander De Lorde Royal Du Dragon Dannam. Among the incidents of Sir John Pender's home career, special reference must be made to his long connection with the House of Commons.

X Rays and the Aurora Borealis.

A series of experiments of the greatest interest, relative to the action of a powerful magnetic field upon the cathodic rays in Crookes or Hittorf tubes, has been undertaken by Mr. Birkeland, who has published the results thereof in the *Elektroteknisk Tiddskrift*, of Christiana.

These experiments show that in such a field the cathodic rays are considerably deflected in the direction of the lines of force, and may even be concentrated upon the surface of the glass to such a degree as to cause the fusion of the latter. Much more than this, they clearly prove that the rays that emanate from one and the same cathode fall in groups whose physical constants are connected by some definite law, just as are the frequencies of the different tones emitted by a rod in vibration.

These researches present some importance as concerns the theory of the aurora borealis. As well known, Mr. A. Paulsen, the learned director of the Meteorological Institute of Copenhagen, claims that the aurora borealis owes its origin to the phosporescence of the air produced in the upper regions of the atmosphere. Mr. Birkeland puts forth the idea that terrestrial magnetism may be the cause of such phosphorescence, which becomes intensified in the vicinity of the terrestrial poles.—*L'Electricien.*

President Wheeler, of the Wheeler Reflector Company, 18 Washington street, Boston, is traveling in Europe with a party of friends.

COMBINED ELECTRIC LIGHTING AND TRACTION PLANTS.

READ BEFORE THE MUNICIPAL ELECTRICAL ASSOCIATION, ENGLAND, JUNE 11, 1896, BY JOHN HESKETH AND JOHN H. RIDER.

From the time when corporations commenced the supply of electrical energy for lighting purposes, up to the present, it has been continually and emphatically stated and proved that the one thing operating against its cheaper production is the smallness of the load factor, or percentage period of use of the plant. Many suggestions have been made as to means whereby this great drawback of cost could be overcome, but none have found such favor as the one for providing a load for the plant during the hours of daylight—in other words, to provide a constant or nearly constant load. In every business large output, with the minimum of plant, means cheap supply, and in the case of electrical supply large and uniform demand undoubtedly is the one thing needed to reduce its cost.

All this has long been admitted, and no claim is made by the present writers to originality either in the reasoning or application. Indeed, to all engineers interested in electrical supply it must be as dreary as a twice-told tale. But there may still be many in the governing bodies, the councils of our corporations, who have not accepted and absorbed the fact, and carried it out to its logical conclusion and practical application.

The tendency during recent years to municipal control of local transit offers an excellent opportunity of pointing another object lesson, and adding a further example to the many already adduced, of the way in which electrical supply may be cheapened by judicious foresight and careful application of our present knowledge.

Many corporations at the present time own, but do not work, their tramways, and in the near future it may be safely prophesied that those corporations who willingly lease their lines will be in a minority. In almost every instance at present the lessee provides the motive power, generally horses, to deal with the traffic on lines constructed by the lessors. Therefore, when the time for a revision comes, and corporations begin to work their lines themselves, they will probably be left to provide a complete equipment of new rolling stock and motive power.

That electricity will be considered is certain; that it will be adopted in many instances is equally certain. But there still remains one very important question to decide in connection with the generating plant, and that is, shall the plant be separate and distinct, or shall it be combined with a plant for electric lighting?

In many cases the plant for electric lighting will already exist, most probably on a system unsuited for direct application to tramway purposes; and the tendency may be to say that as the purposes are distinct, then keep the plants separate and distinct. To show that this tendency is wrong is the object of this paper.

Whether two separate systems be used in the one building, or whether both plants be identical, the combination has already been carried out to a practical issue in America, Europe, and elsewhere. That it has not been hitherto done in England is due rather to force of circumstances than a lack of appreciation of the practicability and importance of the combination.

In cases where low-tension direct-current systems are in use for lighting, the question is very simple. If the voltage employed for lighting be unsuited for tramway purposes, a motor transformer can efficiently be used. This also holds good for an alternating high-tension system—in fact, be the voltage or current of the lighting plant what it may, motor transformers can be arranged to supply a suitable current for the tramways, generally continuous at 500 volts.

There can be no doubt in any one's mind as to the possibility of the combination, and it would result in cheapened supply for both purposes. Such a combined plant, worked economically, ought to produce current for all purposes at from one and one-half pence to three pence per unit, according to the demand. This is simply due to the combined load factor being a very good one. Were the load factor of a lighting station equally good, the cost of production would be equally low. This is demonstrated in more than one instance in practice. Indeed, it seems almost useless repeating the arguments in favor of it so sure are they, and so strong has the evidence up to the present been in favor of such a scheme. To quote from a recent publication:

"This has been realized on the continent, where, in several large towns, the tramway companies are buying current from municipal electric light works. The lowest price paid is at Geneva, where the tramway company guarantees a minimum consumption of 500,000 units per annum, and pays 1.15*d.* per Board of Trade unit.

"Hamburg is another example of a tramway company buying current from the lighting station. In this case the tramway company guarantees a minimum annual consumption of 2,500,000 units. The lighting company has to pay a fine of 9.6*d.* for every car mile which the tramway company may not be able to run, owing to any failure of the power plant. The total expenses of the tramway company, including depreciation, maintenance, interest on bonds, sinking fund, etc., are only 3.95*d.* per car mile.

"Hamburg has, so far, the largest electric tramway system in Europe, and its success is an accomplished fact. The management state in the last annual report that the introduction of electric traction has, without the slightest doubt, very much improved the earning capacity and diminished the working expenses of the system; further, that on the lines

where electricity has superseded horses, the number of passengers carried has increased more than 32 per cent and the receipts have increased nearly 35 per cent."

At Havre, too, the tramway company buys current from the lighting company, and at 1.75*d.* per unit. In all these cases it must be evident that it is of advantage to both supplier and supplied to continue the arrangement, or it would ere this have ceased. The same reasons hold good for the introduction of such systems into our municipal undertakings.

The question as to the system on which the combinations should be made is a most important one, which we will now briefly consider.

We may have (*a*) a separate and distinct tramway plant within the same station buildings as our lighting plant and under the same management and control; or (*b*) we may utilize the existing lighting machinery by various methods.

If we adopt the former, we shall require separate engines and generators, and also additional boilers, which, however, may be worked in conjunction with the existing boilers and steam pipes. In other words, we shall require nearly as much extra plant as though the tramways were being worked from a distinct station. The only advantages will be that the existing buildings (enlarged) and the existing lighting staff and management will be available.

It is clear that this must be so, when we remember that the tramway load will not conveniently shut down as darkness comes on, and that, for a few hours each day, chiefly during the Winter months, the whole of the lighting plant will be required for lighting purposes, and during this time the tramcars will have to be driven as well. The effect of this combination will, therefore, be to give an excellent day load (after 6 A. M.), but it will also increase the "peak" by an equal amount. Fig. 1 endeavors to show this in a rough way.

This is a great improvement on the load factor of the station, but can not we go one better?

If we utilize the existing machinery of the station for driving the cars, we must, in the first place, supply a current suitable for tramway purposes, and in the second place, provide power for running the cars during the time of the heavy lighting load.

As mentioned earlier, if the ordinary station supply be not suitable for direct use, we may obtain anything we want by means of rotary transformers; *i. e.*, by coupling a continuous-current generator to a continuous-current motor in the case of a direct-current supply, and to an alternating-current motor in the case of an alternating supply. The combined motor-generator could be conveniently placed in a sub-station close to the tramways, and should be provided with a specially designed heavy flywheel, in order to minimize the effect of the starting of the cars upon the station machinery.

The power required for driving the cars during the period of heavy lighting load may be obtained from accumulators. These should be of sufficient capacity to drive the cars for, say, five hours. The actual number of hours they would be required would vary with the time of the year, but in the depth of Winter it should not be more than this, while in the Summer months it would be very small indeed. These accumulators would be charged directly from the station machinery, if suitable, or from the same motor generators which

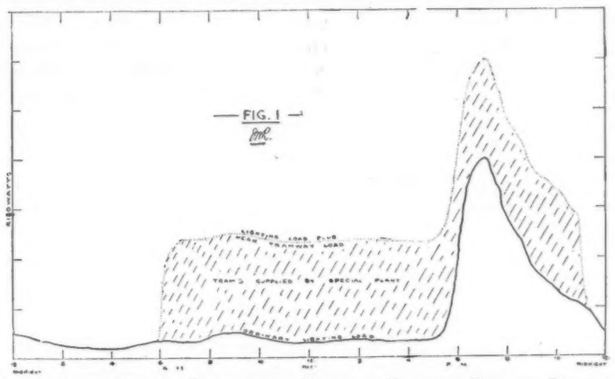


FIG. 1.—LOAD DIAGRAMS ILLUSTRATING PAPER ON COMBINED ELECTRIC LIGHTING AND TRACTION PLANTS.

supply the cars in the day time. A sample Winter's day working would be somewhat as follows, viz.: 11 P. M. to 6 A. M. (seven hours). Car traffic stopped. Motor generators charging accumulators at full rate. Only small lighting load.

6 A. M. to 5 P. M. (11 hours). Cars running. Motor generators supplying current for cars in parallel with accumulators, which would then be fully charged. Accumulators helping to furnish such sudden heavy demands as may be required, and also being partially charged when cars were only taking small current. Full steady load could thus be kept on motor generators and station machinery all day. Only small lighting load.

5 P. M. to 10 P. M. (five hours). Cars running. Motor generators stopped or running light. Accumulators supplying entire current for cars. Heavy lighting load.

(As explained above, the actual demand upon the accumulators would depend on the time of the year and the requirements of the lighting load.)

10 P. M. to 11 P. M. (one hour). Cars running, but gradually ceasing. Lighting load going off. Motor generators helping to drive cars, and gradually increasing until full power could be put on for charging the accumulators.

Fig. 2 shows the effect of this method of working, and it should be compared with Fig. 1. Not only is the load factor a splendid one, but the maximum output of the station is reduced to the maximum demand of either the lighting or the tramway load (whichever is the greater), and not to the sum of them. The actual shapes of the curves in Figs. 1 and 2, and the effect of the tramway load upon the system, will, of course, depend entirely upon local conditions, and will probably vary in every case.

The use of accumulators in the manner described would have the great incidental advantage of rendering the car service independent of a temporary breakdown of the plant, either in the case of a motor generator or any part of the generating machinery. The fields of both motor and generator could be excited by current from the accumulators, and the latter could also be used, in alternating-current systems, to run the plant up to synchronous speed before switching on to the high-tension alternating mains. The accumulators would also help (in conjunction with the heavy flywheel on the motor generator) to lessen the effect of the starting of the cars upon the station machinery, so that the station load would only vary slowly, and that to a small extent, with a fair number of cars running.

It may be asked, "Where is the accumulator which will do all this?" We all know that accumulators have been tried for traction purposes, with disastrous results, but in such cases they have been carried *on the cars*, and have had to do the entire daily load. In the scheme suggested the accumulators are stationary, are subject to no jolting or other mechanical strains, and are under skilled supervision at all times. Instead of being called upon to drive the cars the whole day through, they would only, at the outside, have to do about 25 per cent of the total work, and that only for a few months in the year. On the average, about 15 per cent would be their share. The sudden rushes of current on starting the cars would be partly met by the heavy flywheels on the motor generators, so that the life of the accumulators should be fairly good.

So far as prime cost is concerned, there is very little to choose between this arrangement and the former. The motor generators would cost about as much as their corresponding power in direct-acting steam plant, while the accumulators could be purchased for the money otherwise expended in spare steam plant, boilers, pumps, pipes, boiler seatings, and extended station buildings. But in the annual running expenses there would be some economy, particularly with respect to the boilers. If a distinct plant were used for the trams, steam would have to be kept up all day in sufficient boilers for the full tramway and lighting loads, as all the power would be required when darkness came on. This would mean both a larger chimney and also more stokers, while the fuel and water consumption would be increased.

The motor generators being simply rotary machines, there would not be the same wear and tear as on the separate steam engine plant, while a 10 per cent to 15 per cent charge should maintain the accumulators, particularly as makers will now enter into maintenance rates for lighting cells at only four per cent per annum.

The question of a good day load, and consequently cheapened production, is of such vital importance to our industry that it will repay every attention which can be given to it. That a combined station is the right thing there can be no doubt. As to which system the combination should be carried out upon, there may be differences of opinion, and it is to bring out those differences of opinion that this paper is laid before you.

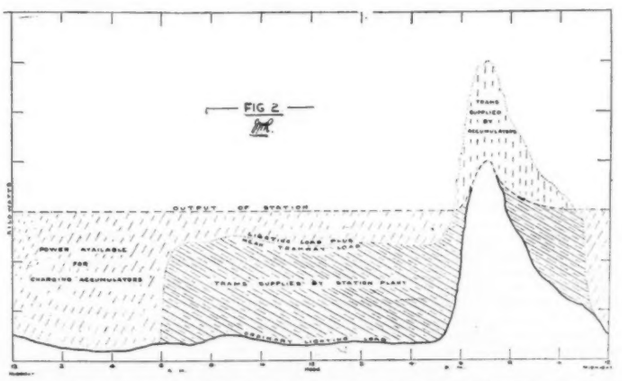


FIG. 2.—LOAD DIAGRAMS ILLUSTRATING PAPER ON COMBINED ELECTRIC LIGHTING AND TRACTION PLANTS.

Receiver Requested for the Brush Electric Company, of Baltimore.

T. J. Cannon has applied to the Circuit Court for an accounting from the Brush Electric Company, of Baltimore, and for the appointment of a receiver for the United States Electric Power and Light Company, of Baltimore. Judge Ritchie has signed an order requiring the defendants to show cause by August 10 why a receiver should not be appointed.

The electric light plant of Adrian J. Reynolds, at Theresa, N. Y., has been seized on a warrant obtained by John D. Cole, subject to the rights of the lessees, Stockwell & Parker, and to a chattel mortgage held by Frederick L. Stanton. This property is inventoried at $2,500.

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SPECIAL NOTICE TO ADVERTISERS.

***CHANGES** for advertisements must be in this office by Friday noon for the following week's issue.*

***NEW ADVERTISEMENTS** should be in the office not later than Saturday noon to insure publication the following week.*

NEW YORK, JULY 29, 1896.

CONTENTS.

	PAGE
Views, News and Interviews	49
Electric Lighting in Detroit	49
Johnson & Steele Automatic Potential Arrester.	51
Electricity and Water Power	51
One Hundred Thousand Penberthy Injectors	51
Sir John Pender	52
X Rays and the Aurora Borealis	52
Combined Electric Lighting and Traction Plants.	52
Receiver Requested for the Brush Electric Company, of Baltimore	53
Electricity and the Nervous System	54
Have the Walker and Stanley Companies Joined the Combine?	54
The Financial Side	55
Telephoning Political News	55
Personal	55
New York to Philadelphia by Electric Railway	55
Obituary	55
Telephone News and Comment	56
Literary	56
ELECTRICAL REVIEW Displays Enterprise	56
The Clonbrock Steam Boiler Company	57
The Up-to-date Fakir and the X-Ray	57
The Organic Membranes as Insulators	58
Electric Light Flashes	58
Electric Railway Notes	58
Alternating-Current Motors	59
Advance Information	60
Kindred Interests	ix
Electrical Patents	x
A New Insulating Material	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire.	i
Armington & Sims, engines	xvi
Babcock & Wilcox Co., boilers	xvi, ix
Beacon Lamp Co., incandescent lamps	i
Bristol Co., recording voltmeters, etc	i
Bunnell & Co., J. H., dry batteries	i
Day's Kerite, insulated wire	i, viii
Electric Appliance Co., supplies	i
Goubert Manufacturing Co., heaters	xvi
Greeley, The E. S., & Co., electrical supplies.	i
Hampson, E. P., & Co., engines	xvi
Interior Conduit and Insulation Co., Lundell dynamos and motors	i
Lombard Water Wheel Governor Co	xvi
Morris, Tasker & Co., tubes, poles, etc	ii
National India Rubber Co	i
New York Insulated Wire Co., Grimshaw wires and cables	i
Okonite Co., insulated wire	i, xvi
Partridge Carbon Co., motor and generator brushes	i
Roebling's, John A., Sons Co., lead-encased cables	xvi
Safety Insulated Wire and Cable Co	i
Splitdorf, C. F., induction coils	i
Standard Paint Co., insulating compound	i
Stanley Electric & Mfg. Co	ii
Stirling Co., water tube boilers	xvi
U. S. Mineral Wool Co	ii, v

INSIDE PAGES.

Addystone Pipe and Steel Co	vi
American Bell Telephone Co	xiii
American Electric Telephone Co., long-distance telephones	xiii
American Engine Co., American-Ball engines	iv
Babcock & Wilcox Co., boilers	ix, xvi
Baechtold & Parker Electric Co., American arc dynamos	ix
Baker & Co., platinum	v
Ball & Wood Co., engines	iv
Baxter, H. E., & Co., electrical supplies	ix
Boettcher, C	x
Brady, T. H., Brady mast-arms	vi
Brill, J. G., Co., railway cars	viii
Brixey, W. R., Day's kerite wires and cables	viii
Brush Electric Co., electric lighting and power apparatus	v
Buckeye Electric Co	iv
Central Electric Co., fans	iii
Central Islip Improvement Co	ix
Chase & Vale, patent attorneys	x
Connecticut Pipe Mfg. Co	xi
Connecticut Telephone and Electric Co	xii
Consolidated Telegraph and News Co	v
Cutter Electric and Mfg. Co	ix
C. & C. Electric Co	viii
Dayton Globe Iron Works Co., new American Turbine	xi
Diehl Mfg. Co., fans	vii
Dixon, Jos., Crucible Co., belt dressing	iii
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Edison Mfg. Co	iii
Electric Storage Battery Co	xii
Empire China Works, porcelain specialties	xii
Eppenger & Russell Co., Valentine subway electrical conduit	vi
Faraday Carbon Co., carbons	iv
Farr Telephone Construction & Supply Co.	xiii
Fort Wayne Electric Corporation	xii
Gordon-Burnham Battery Co	v
Hano, Philip, & Co	vi
Hooven, Owens & Rentschler Co., electric railway and electric light engines	iii
Huebel & Manger, bells, push buttons, etc	ix
India Rubber and Gutta Percha Insulating Co	viii
International Correspondence Schools	ix
Jewell Belting Co	v
Keystone Telephone Co	xiii
Knott, L. E., Apparatus Co	x
Leffel, Jas., & Co	vi
Lehigh Valley Creosoting Co., creosoted lumber	vi
Manhattan Electrical Supply Co	xii
Marshall, Wm., condensers	ix
Mason-Maxwell Telephone Mfg. Co	xiii
McIntire, C., Co., The, connectors and terminals	ix
Metropolitan Electric Co	vi
Mianus Electric Co., telephones and electric supplies	xiii
Michigan Electric Co	viii
Moore, Alfred F., insulated electric wire	v
Morrison Southern Electric Co	xiv
National Pipe Bending Co	iv
New England Engineering Co	xi
Novelty Electric Co., supplies	iii
Ostrander, W. R., & Co., supplies	vi
Pettingell-Andrews Co	ix
Phillips Insulated Wire Co., wire	viii
Replogle Governor Works	xi
Royce & Marean, electrical supplies	xi
Rushmore Dynamo Works	x
Safety Car Heating and Lighting Co	vi
Solar Carbon and Manufacturing Co	v
Standard Underground Cable Co	viii
Sterling Supply & Mfg. Co	vii
Telephone Construction Co	xiii
U. S. Mineral Wool Co	v, ii
Utica Electrical Mfg. & Supply Co	ix
Viaduct Mfg. Co., telephones, etc	xiii
Wanted	iii
Warren, A. K., & Co	v
Washington Patent Agency	x
Western Electric Co., fans	xiv
Western Telephone Construction Co	xii
Westinghouse Electric & Mfg. Co	xiv
Weston Electrical Instrument Co., measuring instruments	viii
White-Crosby Co., contracting engineers	ix
Whitney Electrical Instrument Co	ix

The Calumet & Hecla Mining Company recently sold 20,000 tons of machinery for scrap iron. This represented an original expenditure of between $3,000,000 and $4,000,000. The machinery was out of date and was disposed of to make room for more modern devices. Such evidences of enterprising progressiveness are encouraging.

ELECTRICITY AND THE NERVOUS SYSTEM.

On another page in this issue of the ELECTRICAL REVIEW will be found a very interesting paper, entitled: "On the Organic Membranes as Insulators," by Sir Benjamin Ward Richardson, M. D. The author seems to have proved by actual experiments that various membranes of the animal body, in addition to performing their well known functions, are also electrical insulators, and by their presence confine and render useful the vital force that is developed in the organs they surround. Sir Benjamin describes in detail his method of experiment, and the conclusions he has reached, after experimenting on seven kinds of membranes, show them to be true insulators. The question of the effect of the absorption of water by a membrane, as in the case of dropsies, he leaves for future investigation.

In this connection it is interesting and instructive to turn to a scholarly article by Mr. J. J. Carty, entitled: "Is Electricity Related to Nervous Force?" published in the ELECTRICAL REVIEW for February 20, 1892. Mr. Carty begins by saying that Faraday hoped to discover some such relation between electricity and nervous force as exists between electricity and magnetism, or electricity and heat. Priestly, as early as 1774, held that electricity and nervous force were identical. Dr. Wilson Philip, Matteucci, Prevost and Dumas all held a similar view. "But," says Mr. Carty, "the identity of electricity and nervous force has not been established, and there is no more absolute proof that nervous force is a manifestation of electrical energy than there is to show that the rope of a church bell is sound. On the other hand, it has not been proved that nervous force is not an electrical phenomenon, and thus the subject still possesses all of its original interest and importance."

One of the most striking statements made by Mr. Carty is this: "The general similarity between a telegraph cable and a bundle of nerves is so obvious that long ago electricity was suggested as the possible agent employed, and an examination of the nerves revealed a formation likened to the conductor and insulation of electric wires. But here the investigation seems to have rested." Mr. Carty then goes on to compare the nervous system to the wire network and cable system of a telephone exchange.

Another statement which has a strong bearing on Sir Benjamin's paper is as follows: "It is admitted that the nervous conductor is insulated so as to prevent the accidental transmission of the impulses to its fellows, and certain sheaths have been recognized as performing this function. But in such an extremely sensitive organization, one is justified in the expectation that interfering impulses might be transmitted laterally between nerves by some means not depending upon contact, as in the case of the telephone system under comparison, where a signal is transmitted inductively between wires separated by several feet of perfectly insulated sheaths. Now, if such an action is possible, there must be some means adopted by nature to avoid it, and it is here that certain incisions and indentations of the nervous envelopes become of interest when examined as being possible 'anti-induction' appliances."

We would suggest to Sir Benjamin Ward Richardson a careful perusal of Mr. Carty's article referred to, as the results of his investigations just recorded eminently qualify him to follow out the suggestions outlined by Mr. Carty four years ago.

HAVE THE WALKER AND STANLEY COMPANIES JOINED THE COMBINE?

A well defined rumor was in circulation in New York city last week to the effect that the Walker Manufacturing Company, of Cleveland, Ohio, and the Stanley Electric Manufacturing Company, of Pittsfield, Mass., had joined the patent combination recently put into effect between the Westinghouse Electric and Manufacturing Company and the General Electric Company. The rumor lacked confirmation, but was believed to be true in quarters usually well informed on such matters.

The Walker company is the defendant in 20 or more suits brought against it by the General Electric Company for alleged infringement of several electric railway patents. The Walker people have recently brought out an overhead trolley which is claimed not to infringe any existing patent.

The Stanley Electric Manufacturing Company is the owner of a valuable and meritorious system of combined light and power distribution by alternating currents. This company builds the highest class of apparatus and has installed a number of long-distance transmission plants of high efficiency.

In casting up the electric railway progress made during the 12 months of 1896, we predict that this year will be the greatest yet in electric traction development.

THE FINANCIAL SIDE.

An important change for the better occurred in the financial situation this week. It was caused by a decision on the part of New York bankers to supply gold to the amount of $22,000,000, and possibly more, to restore the reserve and keep it above the safety point until after the election. Part of the plan is co-operation among the exchange houses, which includes the formation of a syndicate to go short of something like $75,000,000 of exchange, against cotton and produce futures. This had the immediate effect of checking the decline in stocks. It caused a sharp rally during midweek, and in the latter days hardened the market on a level some 3 or 4 points above the low. Political news, which a week ago was ignored, was again accorded first place and was more or less influential in determining values. The campaign will not be begun in earnest until next week, and from that time on the movement in stocks is likely to reflect the growth of sentiment in favor of or against the gold standard. Business is deprived of the opportunity of discounting the future, or at least a gold victory, and for this reason no material improvement is anticipated. Buying in almost all branches is hand to mouth. Prices, however, owing to past reductions, are, with the exception of iron and steel products, nominally unchanged.

Electrical securities rallied along with the others, General Electric going from 21 early in the week to 25¼. It had a fractional reaction and closed steady at 24. On almost every side I meet with favorable comment on the General Electric Company and its business. It is certainly on a basis discounting the worst that could happen under a silver reign, and has room for very marked improvement in price if present conditions continue. It is showing heavy increases in earnings. An apparently well grounded statement appeared during the week from Boston, in effect that the company recently retired some $90,000 of its debenture bonds, and that its policy is to employ its surplus in this manner, hoping thereby to correct, in a large measure, its capital impairment. Meanwhile it is making no move to determine the rights of preferred shareholders to accrued dividends. Something like $1,000,000 is due on this account.

Western Union was subjected to a bear raid, which carried the price down to 77½, from which figures it rallied, touching 79¾ on Thursday; subsequently it sold off a little. There was a total absence of electrical bond transactions. This speaks well for the strength of holdings, in view of the general liquidation that recently took place in investment securities. Unlisted securities of every class are a drug in the market, and if the electric and telegraph shares, quoted in this column monthly, should be forced upon the market, great sacrifices would result. My advice to owners is to hold on.

The compressed air tests on the Lenox and Third avenue lines, that are about to be made, created a ripple of interest in financial circles. The impracticability of air is generally admitted by authorities not directly interested; but, nevertheless, a possibility exists which is not relished by the large equipment companies.

New York, July 25. BAIN.

TELEPHONING POLITICAL NEWS.

THE TELEGRAPH AND TELEPHONE AT THE CHICAGO CONVENTION.

The recent Chicago convention of the Democratic party was handled in a thoroughly modern way by the telephone and telegraph people. General Superintendent Bradley, of the Postal Telegraph Company, was present all through the convention, day and night, and personally looked after the interests of the scores of special correspondents and the Associated Press that used his lines. The admirable bulletin reports sent out over the Postal lines were edited by Mr. Bradley and altogether he enjoyed a busy week.

Mr. W. B. Sommerville was present for the Western Union and sent out the usual interesting bulletins for his company. Mr. Sommerville is a veteran in such work, this being his thirteenth national political convention.

The American Telephone and Telegraph Company (long-distance), through the efficient management of Mr. W. A. Vail, supplied instantaneous bulletins that were highly appreciated all over the great system of this company. Mr. Vail was located with his long-distance instrument immediately over the chairman's platform, where everything was easily heard and seen.

The enterprising general manager of the Chicago Telephone Company, Mr. A. S. Hibbard, as mentioned in the ELECTRICAL REVIEW, July 15, arranged with eight of the wide-awake Chicago dailies for direct private telephone lines from "press row" at the convention.

The political writers of the various papers substituted press headquarters at the convention for their offices for the time being, and editorial, descriptive and personal comment were all telephoned direct to the editorial rooms downtown, some seven or eight miles from the convention hall, and taken down there in shorthand and written out and put in type with the greatest dispatch. Thursday night, about 12.30 A. M., the Chicago *Tribune's* private wire became crossed with a telegraph wire where it entered the building. The three minutes that it took the alert telephone inspector to find the cross seemed as many hours to the *Tribune* staff at both ends of the line, as the going-to-press hour was near at hand, but, when the trouble was so quickly cleared up, they became more enthusiastic than ever over the telephone service. It is sure to come to pass that the enterprising newspaper will find more and more use for the telephone.

A party of distinguished electrical men visited Niagara Falls about a week ago to witness tests of some apparatus in the plant of the Niagara Falls Power Company. The party included Messrs. Nikola Tesla, E. D. Adams, W. B. Rankine, P. D. Cravath, George Westinghouse, Jr., H. H. Westinghouse, G. Melville, and T. N. Ely.

PERSONAL.

Mr. Henry M. Whitney has written a letter to the employés of the West End Street Railway Company, of Boston, on the currency issue, advising them to vote for sound money. He announces that he will vote for McKinley.

Mr. W. A. Jackson, formerly of Detroit, is now residing in Chicago, where he represents the vast western interests of the American Bell Telephone Company. No better man for this responsible position could have been selected. Mr. Jackson is making his home, with his family, at the Beach Hotel in Chicago.

General E. P. Meany, assistant general manager of the American Telephone and Telegraph Company, of New York, was a sound-money delegate from New Jersey to the recent Democratic convention in Chicago. General Meany was a prominent and active member of the convention, serving on the Committee on Credentials.

Hon. J. J. Storrow, counsel to the Venezuelan Commission, is well known to electrical men as a patent attorney, and one of the most eminent of the American Bell Telephone Company's counsel. In his report to the commission, Mr. Storrow declares that Lord Salisbury's "Schomburgh line" is a forgery, and says there never has been any British sovereignty in the disputed territory.

Mr. Ed. Kennedy, the popular, as well as handsome, chief clerk of the Auditorium Hotel, Chicago, possesses scores of friends in electrical and newspaper circles. His wide acquaintance among the electrical fraternity, including editors as well as other great men, has made his hotel the electrical headquarters of Chicago, as well as the headquarters of nearly everything else worth having.

Mr. Henry B. Cram, for many years at the head of the Bernstein Electric Company, of Boston, has terminated his relations with this company. Mr. Cram has not decided what line of business he will enter, but will, no doubt, decide to remain in the electrical field. Mr. Cram is very widely known and possesses scores of electrical friends with whom the ELECTRICAL REVIEW unites in wishing him pleasant lines and prosperous vocation.

Mr. R. F. Outcault, who represented the ELECTRICAL REVIEW at the Paris Exposition of 1889, is making fame rapidly through his colored cartoons in the New York Sunday *World*. He is an artist of ability, and possesses a keen sense of humor. His series of Hogan's Alley cartoons have become so well known that a maker of campaign buttons has secured the right to use the central figure of Hogan's Alley society, a jolly kid in a yellow mother hubbard, as a campaign button. On the kid's dress are the words "Hogan's Alley Is Out Fer McKinley." Mr. Outcault's many friends in the electrical field will be glad to learn of his rapidly increasing success.

NEW YORK TO PHILADELPHIA BY ELECTRIC RAILWAY.

AN IMPORTANT DEAL CONSUMMATED, WHICH SEEMS TO ASSURE A THROUGH ELECTRIC LINE BETWEEN THESE LARGE CITIES.

An electric railway deal of unusual importance was consummated in New York city on July 22. A syndicate of Philadelphia capitalists, headed by Mr. J. P. Gandy, acquired from the original owners, by purchase for cash, the New York & Philadelphia Traction Company and the Central Jersey Traction Company.

It is the intention to make this one of the most important electrical enterprises in the country, the idea being to connect New York and Philadelphia by a direct route of electric railroad. It is understood that contracts have already been let for a portion of this road between Bound Brook and New Brunswick, N. J. It is expected that work will be started immediately. The contractor has agreed to finish the first 16 miles of the road by May 1, 1897.

Mr. Gandy, who is at the head of the enterprise, was formerly vice-president of the Electric Traction Company, of Philadelphia, and is a man of considerable means, who is interested in several electric railway enterprises. He is president of the Fairmount Park Transportation Company, which is building an electric railway through Fairmount Park in Philadelphia.

OBITUARY.

George J. Davidson, for eight years in the service of the New York & New Jersey Telephone Company, committed suicide by shooting himself at his home in Brooklyn, N. Y., on July 23. He was a great sufferer from nervous dyspepsia and is supposed to have killed himself while temporarily insane. He leaves a wife and a son, who is also employed by the telephone company.

Abraham L. Bogart, head of the well known electrical firm of A. L. Bogart & Company, New York city, died at Jamacia, L. I., on July 25. He was taken ill while out bicycling with his wife last Saturday and died soon after being carried home. His death is supposed to have been due to apoplexy or cerebral hemorrhage. Mr. Bogart was 80 years old and had been an electrical inventor and manufacturer for many years. His was one of the oldest firms in the electrical business.

Edward A. Eckert, superintendent of exchanges for the New York Telephone Company, died of heart disease, at Asbury Park, N. J., on July 26. He was a brother of President Thomas T. Eckert, of the Western Union Telegraph Company, and W. H. Eckert, president of the Bi-Metallic Electric Transmission Company, of New York city. He was ill only half an hour, and was in his room in a hotel when attacked by his fatal illness. Several weeks ago Mr. Eckert was severely injured in a bicycle accident, but it is said that this had nothing to do with his death. He had been connected with telephone and telegraph interests for many years.

TELEPHONE NEWS AND COMMENT.

The underground wire ordinance is still hanging fire at Toledo, Ohio.

Hudson River Telephone has declared a dividend of one per cent, payable August 1.

The Citizens' Telephone Company, of Grand Rapids, Mich., is having considerable trouble through some malicious person cutting their circuits.

The Central Union Telephone Company on July 16 passed its quarterly dividend. The reason given is that its bonds issued in March were not all sold.

The Board of Electrical Control of New York city has transferred the franchise of the Metropolitan Telephone and Telegraph Company to its successor, the New York Telephone Company.

Mr. S. T. Thomas, attorney for the District of Columbia, has advised the Commissioners to refuse the request of the Chesapeake & Potomac Telephone Company for permission to remove overhead wires from one locality to another in Washington.

The Cumberland Telephone and Telegraph Company is arranging to extend its lines from Evansville, Ind., to all the surrounding towns of any importance. The circuit will be completed to Oakland City, Jasper, and Huntingburg in a short time.

The telephone committee of the Erie, Pa., Board of Trade has started out to secure stock subscriptions for the proposed new mutual telephone company. The promoters of the new company say that the exchange will be opened as soon as 450 subscribers have been obtained.

The 46 druggists in St. Joseph, Mo., have decided that they will use the telephone service of the Missouri & Kansas Telephone Company, and will cut off the service of the Citizens' Telephone Company. This decision was the result of a meeting of the druggists before which the managers of the two telephone companies made arguments.

The subway question is again being agitated in St. Louis. Manager Durant, of the Bell Telephone Company, of Missouri, has asked that December 31, 1898, instead of December 31, 1897, be fixed as the time all wires shall be placed underground. The St. Louis Electric Light and Power Company has asked that the time limit be extended until the end of 1899.

The Central New York Telephone and Telegraph Company has made another request to the Common Council of Syracuse, N. Y., for permission to put its wires underground. The company has submitted to the Council a draft of a proposed ordinance, similar to those in force in Utica and other cities. One of the conditions of this proposed ordinance is that the city may reserve the right to grant subway privileges to other companies.

President Morris F. Tyler, of the Southern New England Telephone Company, announces that a number of important extensions in the telephone service at New Haven, Ct., will be made in a few weeks. Among other things, a standard time service will be inaugurated for the benefit of subscribers. Mr. E. B. Baker, general superintendent of the company, has invented a clock which may be attached to the telephone circuit. The clock is provided with an electric self-winding mechanism, the current for which is supplied by a local battery.

The first annual meeting of the stockholders of the Elizabeth, N. J., Telephone Company was recently held. President Rankin read a long statement of what the company had done during the past year. He told of the opposition the company had encountered from the New York & New Jersey Telephone Company, and of his company's success in overcoming all obstacles. The Elizabeth Telephone Company has, at present, 322 subscribers. The following officers have been elected for the ensuing year: William Rankin, president; Robert W. Waterbury, treasurer, and James McMaster, secretary.

Judge Hall, of the Superior Court at Bridgeport, Ct., has handed down a verdict in the cases of Benjamin F. Squires and wife, of Monroe, against the American Telephone and Telegraph Company, awarding damages of $1,700 and costs. Mr. Squires and his wife were driving to church in November, 1894, when the horse became frightened at a coil of wire left at the roadside by employés of the American Telephone and Telegraph Company, which was building a line through Monroe. The horse ran away, and Mrs. Squires was thrown out and severely injured. Mr. Squires claimed that the wire was left in a careless position, and that it was owing to the negligence of the telephone company that the accident occurred. He brought suit for damages in the sum of $10,000. Judge Hall's decision awards the wife $1,500 for injuries, and allows the husband $200 damages for the loss of his wife's society.

A smart swindling game, in connection with the service of the American Telephone and Telegraph Company, was discovered in New York city last week. It is the practice of the telephone company to look up any one who is called on the long-distance lines, and to tell him that he is wanted at a certain telephone number immediately. A blank form is provided for carrying this message, and the district messenger service of the city is usually employed for this work, the charges being paid in advance. Some one with a knowledge of these facts secured a number of the blanks and started out on a swindling tour. He filled in the blank forms with names and telephone numbers, and delivered them in person. He also collected a charge of 25 cents for the delivery of each message. The person who received the message, not being famil ar with the rules of the telephone company in this respect, paid the charge without protest, and the swindler must have reaped a rich harvest. The first intimation that the telephone officials had of the swindle was when the central exchange was called up several times with word to the effect that the person at the telephone was ready to talk with the party who had called him from out of town. One exposure of this scheme should be sufficient to kill it.

LITERARY.

We have received the eleventh annual report of the Illinois Society of Engineers and Surveyors, containing the proceedings of the society's meeting, held at Galesburg, Ill., January 29, 30 and 31, 1896.

The August *McClure's* justifies its title of a "Mid-Summer Fiction Number" in five short stories, all of them of such fresh and ready interest that one can read them without forcing himself and in spite of heat and humidity. Octave Thanet contributes a strong story of western life; Stephen Crane relates a dramatic episode in the later life of the hero of "The Red Badge of Courage;" Clinton Ross tells a booming battle story, based on Perry's historic victory on Lake Erie; E. M. Thomson tells a humorous tale of the Canadian fishermen, and Annie Eliot describes a double love episode in a Yale and Harvard boat race.

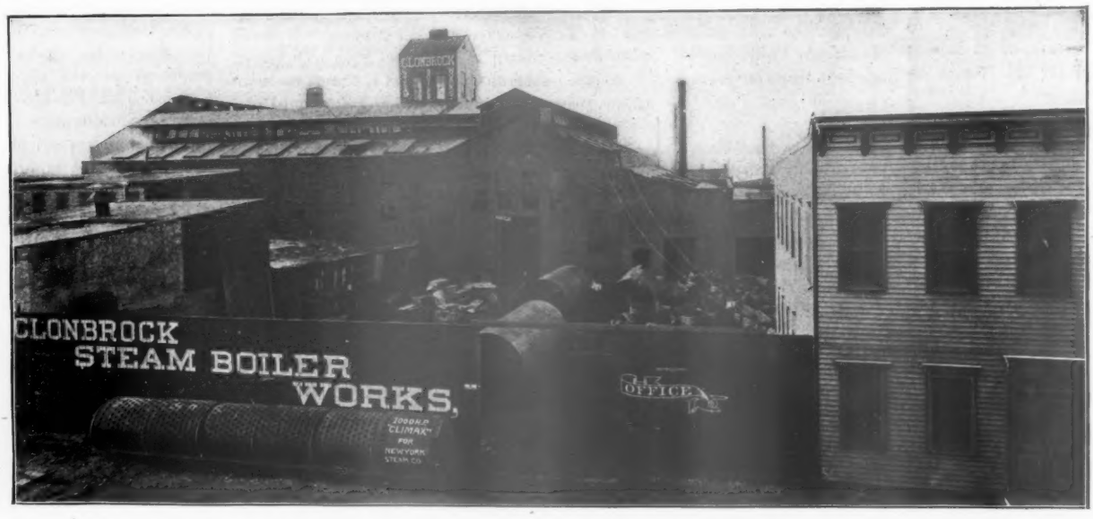

FIG. 1.—PLANT OF THE CLONBROCK STEAM BOILER COMPANY, BROOKLYN, N. Y.

"Electrical Review" Displays Enterprise.

[*From the Buffalo, N. Y., Express.*]

The ELECTRICAL REVIEW has just completed its 28th volume. The energy and enterprise which this journal displays should win increasing prosperity for it.

The Clonbrock Steam Boiler Company.

On December 12, 1888, the Clonbrock Steam Boiler Company, manufacturers of the deservedly popular Morrin Climax boilers, was organized, and began business in a small frame building in Brooklyn, N. Y. The present extensive plant of the company is shown in the accompanying illustration, Fig. 1.

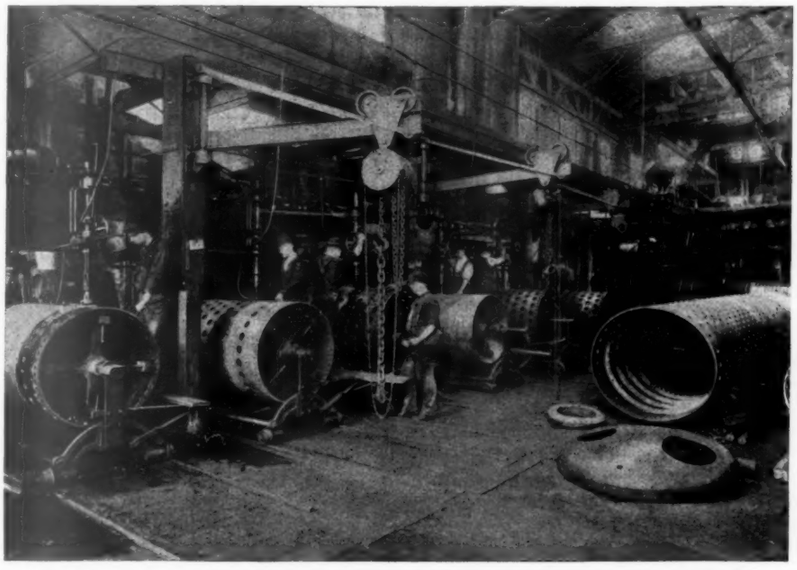

FIG. 2.—SHELL-DRILLING DEPARTMENT OF THE CLONBROCK STEAM BOILER COMPANY.

The boiler is the invention of Mr. T. F. Morrin, president of the company, and is the result of a careful investigation into the subject of steam engineering during 27 years of service as chief engineer for the P. Lorillard Tobacco Company, of Jersey City. It is said that this concern has been able to hold its position against the tobacco trust by reason of the special machinery and mechanical appliances designed by Mr. Morrin, whereby it has been able to produce its goods much more cheaply than its competitors. Mr. Morrin entered the employment of the P. Lorillard Tobacco Company at an early age. He remodeled the mechanical construction of the works; but of all the saving which he was able to perform for this company, it is said that the greatest success has been seen in economy of consumption of fuel and production of steam by the Morrin boilers.

The works of the Clonbrock Steam Boiler Company cover nearly four acres of ground, and, when working to full capacity, employ about 250 hands, having a day and night shift of men. No expense has been spared in equipping this plant with the latest machine tools and the varied apparatus necessary to produce a boiler of this type in the highest state of efficiency. A hydraulic press of 70 tons weight, with a capacity of 2,500 pounds to the square inch, which is used for stamping purposes, enables the company to fashion heavy masses of metal. A table punch, which is claimed to be one of the largest in the world of its kind, has a capacity of 100 holes a minute, and is used in punching work used in connection with water towers and large smokestacks. Conspicuous, also, are the power bending rolls of the largest make; these machines can bend iron one inch thick by 12 feet wide.

In the shell-drilling department, Fig. 2, are seen boiler shells in various processes of construction. Post and traveling cranes and other apparatus for handling heavy weights provide for the quick handling of stock. Fig. 3 gives a view in the pipe-bending department. Here are located some of the experts of the works, as all of the boiler tubes are received in stated lengths and are filled with sand, heated in a retort, and then shaped around a cast-iron form, so that all tubes are exactly alike and interchangeable. Here is also located an auxiliary stock room. The riveting and forging departments are a very busy portion of the works. It is here that all riveting is done by hand. No holes requiring rivets, in the construction of these boilers, are allowed to be punched, but are all made by a twist drill, thus insuring accuracy, and in no case injuring the strength of the metal; and the fact that the company claims that it never had a failure in a boiler shell to stand the prescribed test of 800 pounds cold-water pressure speaks highly for the careful management of this department. A large machine room, where all machine finishing is done, with the necessary tool work upon the fittings for the small parts and boiler trimmings, is furnished with modern tools and all the necessary adjuncts for high-class work.

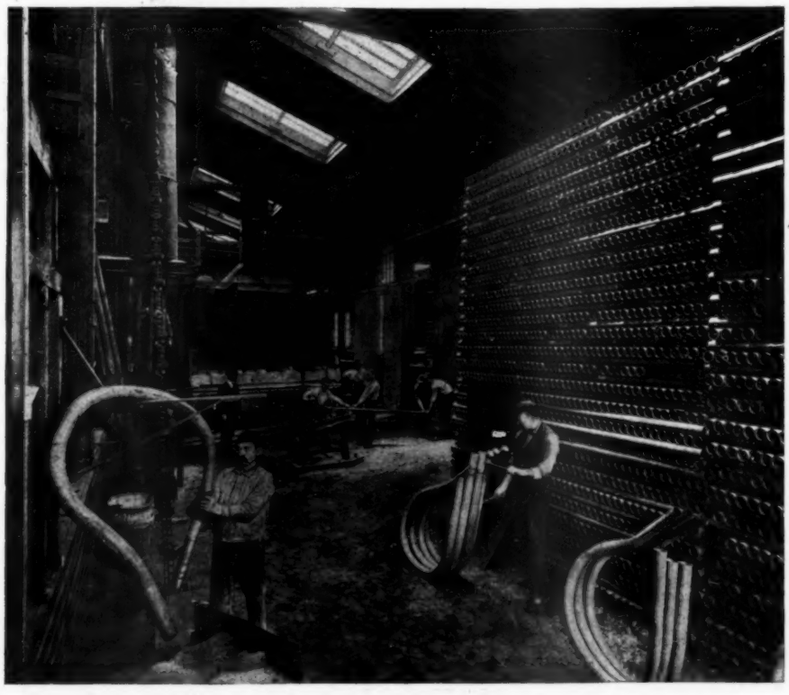

FIG. 3.—TUBE-BENDING DEPARTMENT OF THE CLONBROCK STEAM BOILER COMPANY.

Mr. S. V. Morrin is vice-president and general manager of the company, Col. A. E. Jones is in charge of the sales department, Mr. F. A. Mason is secretary, Mr. J. D. Alexander is superintendent of the works, and Mr. George Baum is in charge of the drafting and designing departments.

The Up-to-date Fakir and the X Ray.

A clever application of an old toy is at present amazing the residents of the lower east side and making a small fortune for the lucky possessors of the secret, says the New York *Sun*. The X ray has caused it. The startling announcement on several push carts, rigged up with some odd-looking tubes, that a peep by the X rays at any object, through brick or board, may be obtained for one cent, has drawn crowds around them. Readers of the *Sun* may remember a toy, known as the "Instrument for looking through a brick wall," that was popular 10 or 15 years ago. It consisted of a U tube, about three inches in diameter, whose ends were turned out. By an inclined arrangement of four small mirrors, one placed at the beginning of the upper bent, one under this, one opposite the second, and the fourth at the last bent, on top, the reflection of any object on one mirror would be transmitted to each successive mirror, until it reached the eye of the observer. Therefore, whatever object was placed in the opening of the U, it could not interfere with the view of any little object placed in line with the bent arms, as the image was formed inside the tubes. This, however, is not exactly as it is adjusted on the carts. To give it an impressive appearance, wires and switches are mysteriously attached to the tubes in a manner that would shock an electrical man. A large hideous sign on the wagon contains this legend:

Edison's X rays for one cent.
Everything made visible.
See the time on your own clock through a brick,

and a glaring picture shows a man, with bulging eyes, peering through an infernal conception of an X-ray machine, from which issue forth enormous red and yellow sparks.

THE ORGANIC MEMBRANES AS INSULATORS.

BY SIR BENJAMIN WARD RICHARDSON, M. D., F. R. S., IN THE LONDON "LANCET."

Up to the present time we have been content to look upon a membrane of the body, the pericardium, the periosteum, the capsule of the kidneys, and any structure of the kind, as a covering of the organ wrapped up in it, that holds the organ, as it were, in a mold, supports it in its place, allows it to glide, and by virtue of the fluid secreted, keeps it distinct and separate. There can be no question that these grand functions belong to the membranes, which have ever been to us structures of the utmost moment. I have watched the influence of many substances upon them; have noted their conditions during the various stages of life, and have examined their degenerations during disease and after death. But I have recently made observations on these structures—membranes—which, if I am right, give them a new value, or rather a value that has not before been appreciated. It seems to me they are electrical insulators, and by their presence confine and render useful the vital force that is developed in the organs they surround. My first observations leading to this conclusion were conducted on the nervous membranes—those that envelop the cerebral convolutions and the spinal cord; from these I passed on to the other membranous envelopes, to find that they all have a common quality.

I obtained an electrical battery consisting of 24 small cells, so arranged that one cell could be put on at a time, or the whole, or part of the whole, as might be required. I commissioned Messrs. Faraday, of Berners street, to construct for me a delicate galvanometer, the needle of which moved in a millimetre circle and certified, with accuracy, the force of the current transmitted. I fixed to one pole of the battery a conductor which was connected to the galvanometer, and from the opposite pole of the battery attached a platinum conductor of the same length and carried it also to the galvanometer. This last conductor I divided in the center and joined the end of the portion from the galvanometer to a platinum disk that was secured by its under surface to a porcelain slab. The other half of the conductor (from the battery) was allowed to remain free with a probe-like end, which could be used at any moment to touch the platinum disk and complete the circuit, or to touch any substance laid upon the disk that would either conduct or break the current. The apparatus, when complete, acted perfectly, and the minutest current could be detected. Sometimes I used the battery with a single cell, sometimes with more than a single cell, while, as a general rule, I used the whole power of cells—24 in number. When all was in order and the battery in action, the platinum probe was brought into direct contact with the platinum disk, and the current was proved by the deflection of the needle on the galvanometer. After this, the needle being steadied and set, a piece of some thin membrane was laid on the platinum disk, and its conduction or resisting power tested with the results to be described.

Dura mater—A disk was cut from the dura mater of a dead sheep, and, after being thoroughly cleaned, was laid on the platinum disk. The probe-like end of the conductor from the battery was then pressed upon it, when the current was found to be completely intercepted. The insulation was, in fact, perfect. A piece of membrane covering the spinal cord at its upper part, stripped off and carefully cleaned, was laid on the platinum disk, and the probe end of the conductor was put upon it. It resisted the current as effectively as a layer of india rubber or gutta percha or a fine slice of fatty tissue could have done.

Periosteal membrane—From off a bone a bit of periosteum detached, cleaned, and laid on the platinum plate, insulated perfectly.

Pericardial membrane—This membrane was tested in the most careful manner and yielded the same result.

Endocardial membrane — There was more trouble with endocardial membrane than with pericardial, for the structure is very fine and strongly adherent to the underlying substance. But when cleanly dissected out, it was found to be as perfect an insulator as the pericardium, so that the heart structure proper is apparently inclosed in two layers of insulating membrane. The endocardial lining of the arteries showed the same character; the valves of the heart cut out entire did not absolutely insulate, but the membrane covering them on either side did.

Peritoneal membrane.—Portions of peritoneal membrane were taken from various parts—from the liver, from the spleen, from the intestine, and from the bladder. When the membrane was derived from any of those sources and scrupulously cleaned and spread out on the platinum disk, it resisted just as the other membrane had done, and proved itself an insulator.

Capsule of the kidney.—The readiness with which the capsule of the kidney can be detached renders it a good specimen for experiment, and it was freely used. It proved to be a perfect insulator, and we may consider that the kidney as it swings in its place is completely insulated.

Lining membrane of an egg.—The thin lining membrane of an egg detached from the inside of the shell, when tested, showed the same insulation.

It was a question whether mucous membrane in the same manner as serous membrane resists the current. To test this fact, mucous membrane was taken from the side of the tongue of a sheep, from the lining of the intestinal canal, and from the lining of the trachea. The membrane had to be carefully cleaned, with the greatest attention to detail, and when it was laid out in its pure character of membrane it also insulated.

In the above, physiological observations have alone been named, but there are pathological ones connected with the subject of equal moment. The absorption of water by membrane, water being a conductor, may interfere with insulation in the case of dropsies, and some deposits may also interfere. But these and other points remain for investigation.

ELECTRIC LIGHT FLASHES.

The Brush Electric Light Company, of Atlanta, Ga., is supplying a large amount of current for motor service.

The Board of Trustees of Hempstead, L. I., have annulled the contract between them and the Hempstead Gas and Electric Light Company, and hereafter the streets of that town will be illuminated by gas.

The Pennsylvania Heat, Light and Power Company, of Philadelphia, is taking steps to build an extensive system for furnishing steam heat throughout the business portion of the city. Chief Engineer Vail has prepared the plans.

The earnings of the Edison Electric Illuminating Company of New York, including its high-tension systems, for June were as follows:

	1896.	1895.	Increase.
Gross,	$159,068.02	$147,637.40	$11,430.62
Net,	67,412.39	72,273.72	5,861.33*
Gross, 6 months,	$1,105,904.64	$1,015,948.19	$89,956.45
Net, 6 months,	544,532.99	491,002.32	53,530.67

*Decrease.

The June statement of the Edison Electric Illuminating Company, of Brooklyn, N. Y., makes the following showing:

	1896.	1895.	Increase.
Gross,	$57,725	$33,023	$24,702
Net,	20,427	9,467	10,960
Surplus,	16,206	7,383	8,883
Six months ending June 30:			
Gross,	$403,411	$249,043	$154,368
Net,	157,135	90,970	66,165
Surplus	132,135	78,470	53,665

Estimates as to the cost of putting in an electric light plant at the State capitol of Wisconsin have been made, the price being set at $13,000, while the annual cost of running it would be $600. It now costs about $5,000 a year to light the building with gas, while the electric lights in the park also cost considerable. A bill was passed by the last legislature providing for a State electric light plant.

An important decision was handed down in the circuit court at Frederick City, Md., recently in the injunction suit of the Frederick Electric Light and Power Company against the corporation of Frederick to restrain the City Register from levying upon the plant of the company for the payment of taxes alleged to be overdue. The court dismissed the application for an injunction on the ground that electricity is not a manufactured article, and that electric light plants do not manufacture current, but simply distribute it. The electric light company will be compelled to pay about $500 back taxes on the plant. It claimed exemption from taxation on the ground that the company operated a manufacturing plant, and that the corporation of Frederick had exempted all manufacturing plants located in the city for a period of five years.

ELECTRIC RAILWAY NOTES.

The Cayadutta, N. Y., Electric Railroad Company has recently installed a new 600 horse-power engine.

Mrs. Phinney and Mr. Adams, of Woodfords, Me., have been granted a joint patent for a guard for open street cars.

The New York State Street Railway Association will hold its next annual meeting at Binghamton, N. Y., on September 8.

The Hartford, Ct., Street Railway Company has recently put into service seven new open cars made by the J. G. Brill Company, of Philadelphia.

During the past year the number of electric street railways in Europe has increased from 43 to 70 and their mileage has grown from 189 to 434 miles.

The Niagara Falls Park & River Electric Railway last year carried 499,015 passengers. The receipts were $65,784 and the operating expenses were $40,630.

A suit has been filed for the appointment of a receiver for the Citizens' Street Railway Company, of Indianapolis, Ind., which operates all the street railways in that city.

The Baltimore, Catonsville & Ellicott's Mills Passenger Railway Company will issue $500,000 of bonds to cover the expense of changing the road from a horse-car line to an electric line.

It is stated that a new electric railway will be built between Springfield, Vt., and Charlestown, N. H. It is said that the work will be commenced within two weeks. The road will cost about $175,000.

The Union Electric Railroad at Saratoga, N. Y., with a line extending to Saratoga Lake and the Geysers, was sold under foreclosure on July 18, and was bid in by Bertron & Storrs, bankers, of New York city, for $8,500, subject to a mortgage of $100,000.

The trustees of the New York & Brooklyn Bridge, will, it is expected, grant permission to the Brooklyn Heights Railroad Company to lay two tracks on the Brooklyn plaza. The company will pay $3,000 a year for the use of the tracks, which are to become the property of the city.

The Santa Barbara, Cal., Consolidated Electric Street Railway Company has struck a splendid flow of water from an artesian well 375 feet deep. This development establishes the location of the power house. It is expected that the road will be in operation by September 1, the date specified in the company's franchise.

An official statement has been made by the General Electric Company, in effect that the denials of the Walker company that it is defendant to a large number of suits, brought for infringement of patents by General Electric and Westinghouse, is only technically correct. It seems that the suits were brought against the user of the apparatus for reasons of convenience instead of against the manufacturer. There are 20 of these actions pending, in which either the Walker company or its patrons are defendants.

ALTERNATING-CURRENT MOTORS.

READ BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION, MARINETTE, WIS., JULY 16, 1896, BY PROF. DUGALD C. JACKSON.

The development of the greatest possibilities of alternating-current central stations in cities of over 15,000 inhabitants as paying properties, requires that a power circuit be operated to give the station a day load; and, while the requirements of the power circuit are fully met by continuous-current distribution at 500 volts, many alternating-current central station men wish to avoid duplicating apparatus. This natural wish may be satisfied to a greater or less degree by using one of the various polyphase systems in the market, but many of the extravagant claims of the manufacturers of alternating-current apparatus, which is designed to be used in a combination lighting and power service, must be dismissed as "points for selling" rather than "facts in operating." It is unnecessary to say in this gathering that only the latter are of interest or value to the central station man.

In the present state of our knowledge, a careful and impartial series of tests of alternating-current motors, the results of which enable a comparison to be made of the performances of the various alternating-current motors with each other and with the well known performance of standard continuous-current motors, is of the utmost value. Various records of the performance of foreign alternating-current motors have been published in electrical periodicals, but the reliability of the record is not always assured, while records of the performance of American machines of this type are very meagre and often bear the stamp of unreliability. Messrs. J. H. Perkins and W. H. Williams, therefore, undertook last Winter to make careful comparative tests of alternating-current motors in my laboratory. This work was carried out in such a way that I can vouch for its accuracy, though it was done while I was virtually confined to my bed with appendicitis. Five horse-power alternating-current motors of the following American makers were available for the purposes of the tests:

Fort Wayne Electric Corporation, single-phase.

Stanley Electric Manufacturing Company, two-phase.

Westinghouse Electric and Manufacturing Company, two-phase.

General Electric Company, three-phase.

A five horse-power three-phaser, made by the Allgemeine Electricitäts Gesellschaft, of Germany, was also included in the tests, and results of tests on machines made by the Oerlikon Works and by C. E. L. Brown, of Switzerland, were obtained. A 10 horse-power Westinghouse two-phaser was also tested. A capacity of five horse-power in the motors to be tested was chosen, as that may be considered to be near the average capacity of motors used in the service of ordinary central stations. The results of the tests may, therefore, be accepted as representing, for the central stations, comparative results between the average motors which they may use on alternating-current systems, and the results may also serve as a basis for comparison between average conditions of operating with continuous-current and alternating-current motors.

When Silvanus P. Thompson wrote his book on polyphase currents, in 1895, he set forth as the requisites for a good alternating-current motor that:

1. It shall exert a good torque at starting.

2. It shall be capable of running at a nearly constant speed at all loads.

3. It shall yield in mechanical power a high percentage of the power put into it (that is, it shall have a high commercial efficiency).

There are three additional requisites which Professor Thompson overlooked, but which determine to fully as great an extent the success of the motor:

A. The motor shall have a high power factor.

B. It shall not require an abnormally large current from the lines at the instant of starting.

C. It shall not cause a large unbalancing of the pressures on the lines of a polyphase circuit.

The requisites, A, B and C, are so important that, if they are overlooked, a motor can not give satisfaction to the central station man, however completely Professor Thompson's requirements are fulfilled. The last two requisites are especially important where the motors are to be supplied directly from the lighting circuits.

In order to determine how far the alternating-current motors in the market fulfill these essential requirements of a machine which will give satisfaction when operated on the circuits of a central station plant, Messrs. Perkins and Williams made tests of the following points:

A. Starting torque and current.

B. Speed regulation.

C. Commercial efficiency at all loads.

D. Power factor at all loads.

E. Starting current.

F. Effect on the line pressures when starting.

The measurements were made by the following methods:

A. The power absorbed by the machine was measured by indicating wattmeters, the two-wattmeter method being usually employed.

B. Currents and apparent watts were obtained from the readings of amperemeters and voltmeters *in each circuit*.

C. Outputs were measured by a special self-adjusting pony brake which proved to be entirely reliable.

D. Disturbance of the circuits upon starting the motors was determined by observing the action of incandescent lamps connected to independent transformers and by voltmeter readings of the pressure on the lines.

E. The torque which the motor could exert when starting ("static torque" of the recapitulation) was measured by clamping the brake up tight and then balancing the pull of the motor. This is by no means the starting torque of the polyphase motors (that is, the torque corresponding to the load which the motor is capable of pulling up to speed), unless the armature starting resistance is subdivided. In only one of the polyphase motors tested was this the case, and all the others showed a starting torque or the maximum-running torque.

The results of the tests are clearly shown in the accompanying table and set of curves, which may be examined at the leisure of the members as published in the electrical papers (as I take it they soon will be), and I at once will advance to the conclusions based on the tests.

Four out of the six motors tested affected the incandescent service disastrously, and showed the absurdity of attempting with them a combined service on the same circuits as the incandescent lighting in those plants where regulation and the satisfaction of the customers is considered of importance. The tests show that the alternating-current motors give equally satisfactory regulation and efficiency as is given by continuous-current motors, but the power factors of most of the machines are small for part load, the starting currents excessive, and the starting torques, with the present arrangement of starting resistance, are unduly small. The best performance of the American five-horse-power machines lies between No. 3 and No. 5 of the tables. These machines will stand well above the others. They are about even in starting torque, but No. 5 will carry considerably the higher load before dropping out of its pace; No. 5 also regulates the better and has the higher efficiency. On the other hand, No. 3 has a power factor incomparably better than any of the other machines. Let us see how the question of efficiency and power factor affect the central station.

1. As power is (or at least always should be) sold by meter, the consumer pays for the losses of his motor, and it is of interest to the central station that the motors have a high efficiency only in order that a fair price per kilowatt hour delivered to the customer may not prove to convert into an excessive or even prohibitive price per horse-power hour, net, which is delivered by the motor to the customer's machinery.

2. On the other hand, the power factor strikes the central station directly; since a low power factor causes an increased-current output, with an accompanying increased loss in the lines and transformers, and, even worse, with a demand for an excess capacity and, therefore, of cost in the generating machinery and transformers.

Supposing that the average load that may be assumed to be carried by a five-horse-power motor is three and one-half horse-power, which is ordinary service, then the average efficiency and power factor of motor No. 3 are 75½ per cent and 83½ per cent, and of motor No. 5 are 85 per cent and 59 per cent. In other words, the central station must install over 40 per cent greater capacity in generators, lines, and transformers to supply a given power service to motor No. 5, than would be necessary if motor No. 3 were used. This difference appears to me to wipe out the difference of 10 per cent in efficiencies. In other words, the central station owner supplying power to motor No. 3 could probably afford, if necessary, to sell his power at enough lower price per kilowatt to make the customer's horse-power of the same cost as if supplied by motor No. 5, and yet make more money and have better regulation on his plant.

The question of power distribution for alternating-current stations, *as it now stands*, resolves itself into this:

1. If you have a 500-volt continuous-current power service, stick to it.

2. If you can develop a large power service within a radius of two miles from the station, put in a 500-volt continuous-current outfit.

3. If you can develop a small power service only, which can not afford a duplication of apparatus, or your distances are excessive, then arrange to use alternating-current motors.

4. In this case, arrange to operate all the lamps on one phase to avoid, as far as possible, difficulty in regulation, and use such a generator and system of lines as will enable the use of motors.

5. Motors intended for such use should be guaranteed to have a high power factor, and to start without taking an excessive current from the lines.

6. Never use recording amperemeters with alternating-current motors, if you really intend to develop a power service, but use recording wattmeters to indicate the power absorbed by the motors.

7. Where two-phase or three-phase motors are used, place two recording wattmeters, properly connected, to indicate the total power by summing their reading. (A single special meter, made up to serve the purpose of the two, may be used, but such an instrument is not now on the market, as far as I know.)

This summation is based on the assumption that uniformity of pressure at the lamps is valued by the central station man.

Carelessness, in regard to regulation, is one of the features which has militated against the financial success of many alternating-current stations, and its importance should be borne carefully in mind when considering the advisability of a combined light and power service. The lighting is generally the most important service to the station, and nothing should be done to injure its regularity and reliability.

The directors of the New England Telephone and Telegraph Company have declared a dividend of $1.25 per share, payable August 15 to stock of record July 31. Books close July 31 and reopen August 17.

ADVANCE INFORMATION

Valuable News and Tips for Manufacturers and Dealers.

We publish below information relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW.

New Electric Railways.

KENSINGTON, MD. — The Chevy Chase & Kensington Electric Railway held annual meeting of directors recently and elected the following: Alphonso Hart, B. H. Warner, Alfred Ray, W. H. Walker, R. B. Detrick, O. R. Harr, W. H. Mannakee, A. R. Phillips, C. Parker Jones, R. W. Walker, and John T. Freeman. The following officers were elected: R. B. Detrick, president; C. Parker Jones, vice-president, and W. Henry Walker, secretary and treasurer.

ST. JOSEPH, MO.—The Missouri & Kansas Trust Company is said to be at the head of a scheme which contemplates the building of an electric system of railway, which is to be operated between St. Joseph, Atchison, Leavenworth and Kansas City.

BENTON HARBOR, MICH. — The Benton Harbor & Eastern Electric Railway has secured right of way over a good portion of the proposed route.

BALTIMORE, MD.—The Baltimore, Gardenville & Belair Electric Railway Company has been incorporated, and has obtained from Mr. Simon J. Martenet, holder of the majority of the stock, the right to construct an electric railway on the Belair turnpike.

BRUNSWICK, ME.—A. F. Gerald, of Fairfield, and I. C. Libby, of Waterville, have purchased one-half interest in the charter rights of Moses & Twitchelt, of Bath, for building an electric street railway, and arrangements have been made for the building of the line just as soon as the municipal officers of both towns may arrange about the location of the track.

NEW HAVEN, CT.—The Manufacturers' Street Railway Company has commenced the construction of a new railway, and has purchased an electric locomotive. The new road will cost between $25,000 and $30,000.

WORCESTER, MASS.—Col. Asa L. Kneeland and others are interested in the organization of a new company to construct an electric railway to Mt. Wachusett, to pass through Holden, Rutland, Princeton and Westminster. The company will be capitalized at $400,000.

WATERTOWN, MASS.—The West End Street Railroad is building a double track, and it is expected that a double line of electric cars will be running to Boston over the street by Fall.

MASON CITY, IOWA—W. E. Brice and L. H. Ong, of Tama, have asked for franchise to build an electric street railway.

ST. LOUIS, MO.—Steps are being taken to connect Alma and St. Louis by an electric railway.

PENSACOLA, FLA.—W. H. Bosley has accepted franchise for an electric street railway.

PITTSBURGH, PA.—The Wilkinsburg & East Pittsburg Electric Railway Company has been organized, with Wm. M. Brinker, president; Geo. W. Black, vice-president. Capital stock, $150,000.

MARLBORO, N. Y.—The Washington & Marlboro Electric Railway Company has been incorporated to build an electric railway from Washington to Marlboro.

BATH, ME.—The Car Trolley Company has been organized, with Warren H. Carr, of Bath, president; Charles R. Donnell, of Bath, treasurer, for the purpose of purchasing and controlling appliances for building, improving and operating electric railways and rolling stock. Capital stock, $10,000.

WILLIAMSTOWN, MASS.—The Hoosac Valley Street Railway Company. Selectmen of Williamstown have been called upon to revoke the franchise of this company.

NEW HAVEN, CT.—Steps are being taken to construct an electric road to run from Hartford to Springfield. Philadelphia syndicate is ready to put money into this enterprise, providing the entrance into Springfield is satisfactory.

ALLSTON, MASS.—It is the intention of the West End Street Railway Company to erect a new car house at the corner of Wilton and Braintree streets. The new building will be 149 feet wide and 153 feet deep. It will probably cost about $30,000.

ATLANTIC CITY, N. J.—Local capitalists are considering the project of building a trolley line from this city to the county seat, May's Landing.

WEST ROXBURY, MASS.—The West Roxbury & Roslindale Street Railway filed a petition with the Railroad Commissioners for approval of an issue of $50,000 capital stock and $150,000 bonds. The company asks for the issue to equip its road with electricity and for the construction of the necessary power stations.

MUNCIE, IND.—A $17,000 contract has been let for trolley wire for the new Gas Belt Electric Railway, and it will be strung as soon as possible. A line is now being surveyed from Muncie to Anderson, and still another from Anderson to Marion.

ALBANY, N. Y.—The Onondaga Lake Railroad Company, capitalized at $250,000, has been incorporated with the Secretary of State. The company will operate an electric road from Clifton Square, Syracuse, to Long Branch in the town of Geddes, Onondaga County, a distance of seven miles.

Electric Light and Power.

ELIZABETHTOWN, PA.—The Elizabethtown Electric Light, Heat and Power Company has been organized. Capital stock, $9,000. Incorporators: Isaac W. Hoffman, E. E. Coble, B. G. Groff, A. B. Demmy, and Charles H. Welchans.

ROCHESTER, N. Y.—Articles of incorporation of the Judson Power Company have been filed in the County Clerk's office. The capital stock is $100,000. The incorporators are L. Lee Judson, Charles J. Judson, Mary L. Brewster, and George D. Hale. The object of the company is to rent out power.

NEW WILMINGTON, PA.—Plans are being prepared for an electric arc lighting system for the streets of this borough. The present electric plant will be enlarged, and power will be furnished for a short railway line.

ASBURY PARK, N. J.—The Asbury Park Electric Light Company has transferred its franchise to the Atlantic Coast Electric Railway Company, and hereafter it will be the latter company which will light the city.

WATERVILLE, ME.—The Waterville & Fairfield Electric Light and Power Company is to make extensive improvements on its plant here. It proposes to put in three more Hercules water wheels, several new machines, and build a large addition to the power house. The cost of these improvements and additions is estimated at $25,000.

BLANCHESTER, OHIO—E. H. Dornette, architect, Ninth and Main streets, Cincinnati, Ohio, will erect a $30,000 electric light plant.

DEXTER, MO.—Isaac Smith, C. E., Chester, Ill., is preparing plans for an electric light plant for Dexter.

SAN ANTONIO, TEX.—The Dubinski Electric Company has been incorporated by Benjamin Dubinski and others, to manufacture electrical machinery, etc. Capital stock, $10,000.

BALTIMORE, MD.—The Bayview Electric Light and Power Company and the Chesapeake Water Company have consolidated as the Chesapeake Electric and Water Company, with a capital stock of $100,000.

GREAT FALLS, MONT.—The Great Falls Electric Light Company. C. N. Atkinson has returned from St. Paul, with a proposition for power from Samuel Hill, to execute its contract.

BALTIMORE, MD. — The United States Electric Power and Light Company; application made for a receiver.

BALTIMORE, MD.—E. H. Bouton has been awarded contract for lighting Roland Park with electricity.

FORT SCOTT, KAS. — The Fort Scott Electric Light, Heating and Power Company has been granted permission to lay and maintain a system of steam pipes in the streets and alleys of the city.

ATHOL, MASS.—The electric light and gas people are about to install a plant at this place for furnishing power.

New Telephone and Telegraph Companies.

HARRISBURG, PA.—A charter has been granted to the North & West Branch Telephone Company to operate a system of telephone lines in the counties of Clinton, Lycoming, Northumberland, Montour, Columbia, Luzerne and Lackawanna. The directors are Monroe H. Kulp, P. Heefinstein, W. W. Ryon and Jesse Shipman, of Shamokin; Clinton R. Savidge, C. M. Clements, Sunbury; Harry K. Smith, Williamsport; C. I. Coon, Wilkesbarre. The company is capitalized at $50,000.

BLOOMINGTON, ILL.—The Western Union Telegraph Company's line between this city and Roodhouse is to be entirely rebuilt.

RACINE, WIS.—The Northwestern Electric Telephone Company has been granted a franchise to put in a system at this place.

AUSTIN, ILL.—Cicero Telephone Company has been organized, capital stock, $10,000, to operate a telephone plant. Incorporators: R. H. Trail, W. O. Cline, Louis Nissen, C. H. Zimmerman, O. J. Roath, George D. Rogers and M. I. Isgrig.

NYACK, N. Y.—The Hudson River Telephone Company is preparing to lay a cable across the river to connect West Point with the long-distance telephone lines up and down the river.

New Manufacturing Companies.

BROOKLYN, N. Y.—The Schlight Combustion Company has been incorporated by Thomas H. Harris, of New York city, L. H. McKinney and Arthur H. Spear, of Brooklyn, to manufacture and deal in machinery and apparatus for the production and application of light, heat and power. Capital stock, $300,000.

NEW YORK, N. Y.—The Electrical Tool Company has been incorporated by Stanley Cunningham, Abraham M. Johnson, L. A. Smith, of New York city, and others. Capital stock, $100,000.

ST. LOUIS, MO.—The Montezuma Electric Company has been incorporated. It is capitalized at $2,400. Incorporators: Arnold Beck, Sr., Arnold Beck, Jr., Ernest P. Olshausen and Henrietta Plate.

NEW YORK, N. Y.—The American Engineering Works has been incorporated, to manufacture and deal in machinery and gas and electric apparatus. Capital, $5,000. Directors: Frank M. Ashley, of Brooklyn, and John J. Haukenhof, of New York city.

NEW YORK, N. Y.—The Fischer Electric Company, to manufacture electric clocks. Capital, $100,000. Directors: James C. White, Frank L. Sheldon and Edward J. Righter, of New York city, and others.

Business Troubles.

NEW YORK, N. Y.—Eclipse Electric Lamp Company has made an assignment to J. R. Keim, $2,704.

KINDRED INTERESTS

W. J. Moore has removed his telephone manufacturing plant from Elmer, Mich., to Caro, Tuscola County, Mich., where he has secured increased facilities.

The Utica Fire Alarm Company, of Utica, New York, are very busy manufacturing telephone switchboards, which are in use by a great many of the independent telephone exchanges of the country.

McLeod, Ward & Company, 27 Thames and 133 Greenwich street, New York, have gotten out a new Ward spark arrester, in two styles, for arc lamps. A descriptive circular will be mailed free on application.

The Southern Railway, Piedmont Air Line, always look after the comfort of their patrons. They have recently placed spark deflectors for use in their through-fare coaches; the use of the device will add materially to the comfort of their coach passengers.

Spencer, Trask & Company have issued an attractive 14-page pamphlet analyzing the operations, earnings, etc., of the Edison Electric Illuminating companies of New York and Brooklyn, and advising the purchase of their securities as conservative investments.

Charles E. Gregory & Company, of Chicago, known as the electrical bargain house, is doing quite a business these days. Mr. A. Louis Kuehmsted, the treasurer and general manager, is well pleased with the constant growth of trade, which does not seem to be affected by the fact that this is a political year.

The Callender Telephone Exchange Company, of Brantford, Canada, are proposing very soon to equip a factory in the United States for the production of their telephone apparatus. This company state that they are now ready to quote terms and make contracts for telephone apparatus. They claim that the Callender system has several advantages over the systems now in use, and can be installed and maintained at a lower cost.

The results secured from some recent tests made on Electra carbons must be very satisfactory to the Electric Appliance Company, Chicago, general western agents for the goods. Some very careful actual-service tests show a length of life and a minimum amount of dust in burning, which is certainly very creditable. They state that a number of their customers are securing the most satisfactory results on constant potential arc lamps using Electra carbons where they had heretofore condemned the lamps as unsatisfactory, when the fault really was with the carbons in use.

A CARD TO THE PUBLIC.

The circular sent out by the late manager of our Boston office has led many to believe that we were changing the location of some of our offices, and that the corporation which he represents is to handle our boilers. This impression is entirely erroneous. No outside concern has been authorized to build our boilers. Without infringing a large number of patents owned by us, no one can build other than a very antiquated form of **Babcock & Wilcox boilers,** and buyers are warned to be on their guard in dealing with any one who offers them.

Our Boston Office is maintained at its old address, **No. 8 Oliver Street,** where we will be glad to welcome all friends and intending purchasers, and any correspondence directed to the **Babcock & Wilcox Co.** at that address will receive our most careful attention.

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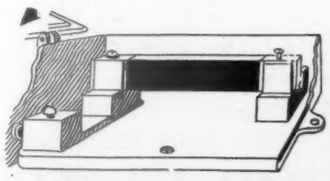

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ELECTRICAL PATENTS

ISSUED JULY 7, 1896.

563,427 Compound-wound multiphase generator; C. P. Steinmetz, Schenectady, N. Y.—Two separate armatures connected in quadrature and energized by different fields, independent circuits extending from each armature, and independent compounding and regulating means in each of the circuits.

563,428 Storage battery; W. J. Still, Toronto, Can.

563,440 Electric motor; E. J. Berg, Schenectady, N. Y.—A means of indicating synchronism of an alternating-current motor, consisting of one or more incandescent lamps connected across the field terminals.

563,442 Electric signaling apparatus; S. S. Bogart, Schraalenburg, N. J.

563,443 Electrical selector; S. S. Bogart, Schraalenburg, N. J.

563,453 Magneto-electro machine, P. J. Crouse, Utica, N. Y.

563,474 Automatic fire alarm; J. W. Frost, New York, N. Y.—Signaling mechanism, and an electro-magnet normally controlling the same, of a closed circuit through the said magnet, the said closed circuit being looped between the magnet and the battery on each side, cross connections, normally open, connecting opposite sides of each loop, and mechanically operated switches adapted to close said cross connections.

563,475 Thermostat and circuit therefor; J. W. Frost, New York, N. Y.—A concave-convex disk, confined at its edges, two or more contact pieces co-operating therewith, the said disk and said contact pieces having an adjustable relation to each other.

563,482 Insulating support for rails of electric railways; P. Haley, Chicago, Ill.

563,491 Electric tunneling machine; H. R. Keithley, Chicago, Ill.

563,501 In and out indicator; J. P. Milbourne, Monton, Eng.

563,554 Process of manufacturing oxides of lead; A. B. Brown, Cambridge, Mass.

563,564 Apparatus for insulating magnet wire; E. F. Cabezola, Trenton, N. J.

563,575 Reversing controller for electric motors; A. C. Dinkey, Munhall, Pa.—A rheostat having arc-shaped main contact plates through which the current always passes in the same direction, separated series of resistances, each series having two sets of contact-blocks, and an arm arranged to move over said arc-shaped plates and said contact-blocks in opposite directions and thereby reverse the current.

563,586 Automatic repeater; J. W. Frost, New York, N. Y.

563,599 Magneto-electric generator; A. G. Leonard, New York, N. Y.

563,600 Rheostat for electric motors; H. W. Leonard, New York, N. Y.—A controlling rheostat having a final protective step of high resistance so as to prevent the net effective electro-motive force in the circuit from sending a destructive current through the rheostat.

563,614 Telephone system; J. Piel, New York, N. Y.

563,715 Electric heater; T. Grutting, St. Paul, Minn.—A heating conductor whose conductivity increases with increase of temperature, and a controling conductor whose conductivity decreases with increase of temperature in series therewith and subject to its thermal influence.

563,716 Electrical insulating sheet; C. W. Jefferson, Schenectady, N. Y.—An electric insulator in sheet form, consisting of layers of asbestos and mica, and adhesive gutta percha tissue between any and every two of said layers.

ISSUED JULY 14, 1896.

563,724 Annunciator system for buildings; J. M. Arthur, Detroit, Mich.

563,743 Circuit controlling device; J. H. Clark, Boston, Mass.—An operating shaft and eccentric thereon, a circuit reverser operated by said eccentric, combined with a crank on the said shaft, a current regulator, a regulating member therefor, a shaft on which said member is pivoted, a pinion on said shaft, and a rack in mesh with said pinion, connected with and reciprocated by said crank.

563,773 Electric arc lamp; J. C. Knight, Roselle, N. J.

563,780 Electric heater; C. H. Minchew, Taunton, Mass.

563,831 L. W. Wooley, Grand Rapids, Mich.—A cylindrical casing adapted to serve as one electrode, two springs serving as the other electrode, and within said casing, and fusible means for securing said spring electrodes to each other and out of contact with said casing.

563,832 Automatic fire-alarm system; J. Young, Chicago, Ill.

563,877 Telephone; W. R. Patterson, Chicago, Ill.

563,895 Rotary transformer; E. Thomson, Swampscott, Mass.

563,911 Dynamo electric machine; W. Cooper, Schenectady, N. Y.—A field magnet structure provided with laminated pole pieces, certain of the laminæ being of less extent than the others.

563,917 Instrument for measurement of electric resistances; Sydney Evershed, London, England.—A cross-shaped magnetic needle system of soft iron, the lower vertical limb of which is adapted as a tube to receive an internal supporting-pin, with surrounding exciting coils, to form an astatic needle.

563,920 Telephone system; A. Graham, London, England.—Two or more stations, independent receiver wires and loud-talking receivers connected with such wires, silent receivers at such stations and a switch at each station for substituting the silent receiver for the loud-talking receiver in the circuit.

563,935 Telephone transmitter; H. A. Martin, Hartford, Ct.

563,940 Dynamo electric machine; A. L. Parcelle, Boston, Mass.—An alternating-current generator, a synchronous rotary transformer and a two-part commutator which is connected to the secondary of the said transformer.

563,960 Electric light for cold-storage rooms; D. E. Hawes, Springfield, Mass.

563,995 Electric generator attachment for dental engines; C. L. Wooley, Baltimore, Md.—A drive pulley for the dental engine, a standard, an electric generator supported by said standard and having a revolvable armature which is driven by contact with said drive pulley.

564,036 Electric headlight for street cars; A. C. Thompson, St. Louis, Mo.

564,054 Electric railway system; D. M. DeWitt, Morrillton, Ark.

564,084 Protective appliance for electrical apparatus; A. de Khotinsky, Boston, Mass.—A rod, or filament, of carbon forming a part of the circuit and held by a spring in tensile or longitudinal strain and means whereby the circuit is opened and grounded when the rod, or filament, is volatilized or disintegrated.

564,173 Telephone exchange apparatus; J. J. Carty, New York, N. Y.

A New Insulating Material.

Electric railway companies and electric light stations are always interested in improvements in insulating materials and will be pleased to know that the Sterling Supply and Manufacturing Company, 97 Bank street, New York city, has just put upon the market a material which promises to take the front rank. This material has been tested by analytical chemists for 18 months, and also by the electrical engineer of the largest trolley system in the East. Under every circumstance the material has proved to be a most efficient non-conductor. So many insulating materials have been the result of imperfect experiments that it is encouraging to find a firm making such thorough tests of their product before placing it upon the market. The Sterling company has employed the best talent obtainable, both chemical and electrical, and is now satisfied that its new insulating material is the best that can be produced. The company has doubled the capacity of its plant, and is fully prepared to do an extensive business in the electrical field, where its different lines of manufacture have already taken the highest rank.

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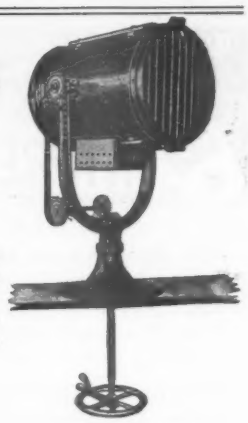

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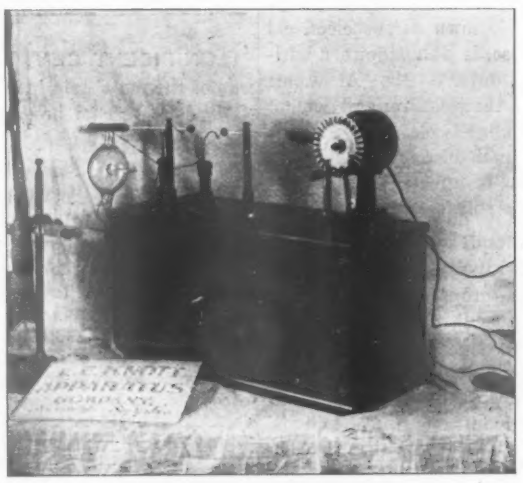

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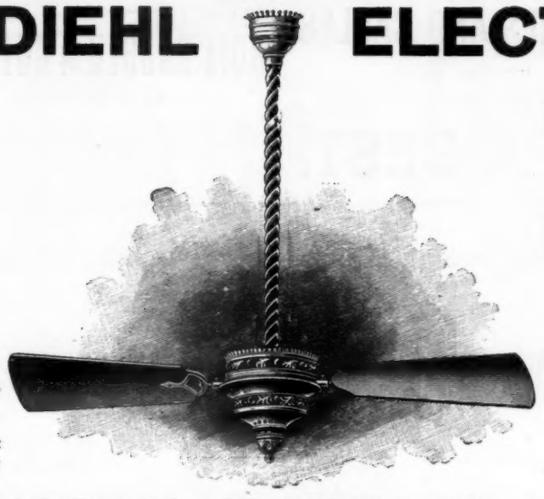

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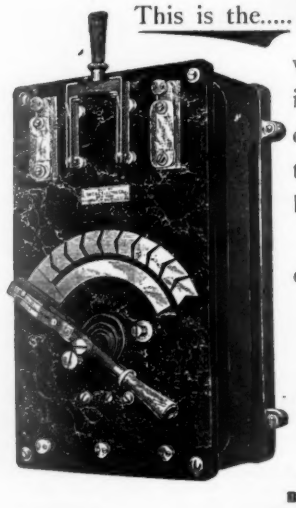

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